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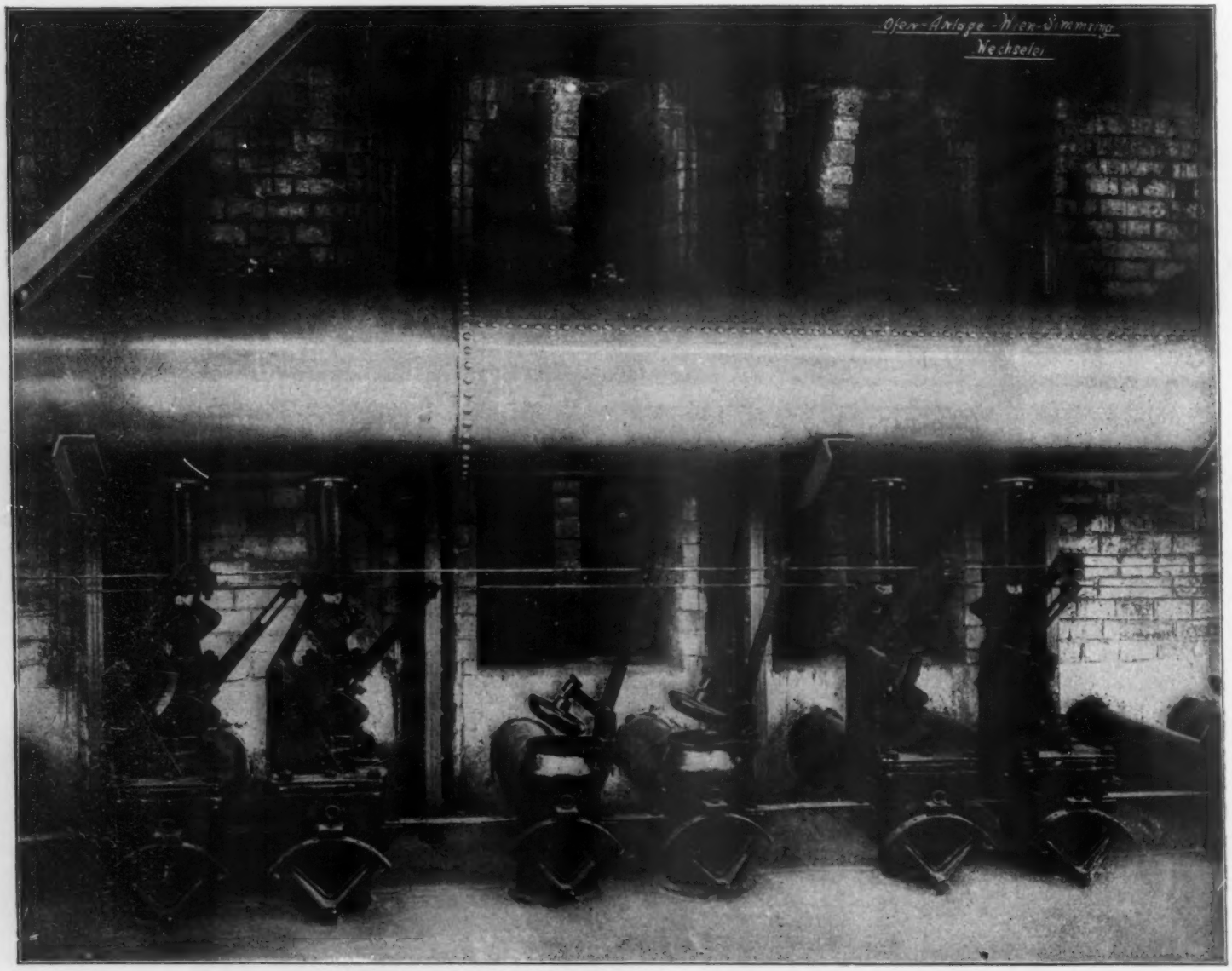

KOPPERS REGENERATORS—GAS PLANT AT VIENNA.

H. KOPPERS COMPANY,

CONSTRUCTORS OF HORIZONTAL CROSS-REGENERATIVE COKE AND GAS OVENS,

5 S. Wabash Avenue, - - - CHICAGO. ILLINOIS.

THE AMERICAN
GAS LIGHT JOURNAL

VOL. XCVIII., No. 1. NEW YORK, JANUARY 6, 1913. WHOLE NO. 1,961.

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Some Notes on Purification of Gas.

[Prepared for the JOURNAL, by MR. R. H. BURDICK, New York.]

In dealing with the subject of "Purification," it is the purpose of these notes to treat briefly the mechanical and chemical removal of the various impurities which are found in artificial gases, as they leave the generating apparatus.

Producer gas, "oil-and-air" gas, or those made from calcium carbide, wood, rosin or other chemical or freak processes, will not be dealt with, but attention will be given to the purifying of the three central station standards: Coal gas, water gas and oil gas.

Notations on the impurities in these three gases will be taken up in the following order:

Tar.	Carbonic acid gas.
Ammonia.	Cyanogen compounds.
Lampblack.	Hydrogen sulphide and sulphur compounds.
Naphthaline.	Iron carbonyl.

Tar owes its presence in coal gas to the process of destructive distillation of coal, and in water gas and oil gas mainly to certain combinations of hydrogen and carbon of the oils used (also, occasionally, oxygen, sulphur and nitrogen) under the influence of high temperatures. In the generation of uncarbureted water gas a small amount of tar is formed by the uniting of nascent hydrogen (from the decomposed steam) with incandescent carbon of the generating fire.

Tar is an extremely complex liquid, best represented by the formula $C_x H_x O_x N_x S_x$. Mr. Lunge states that gas tars contain at least: Seventy-five simple hydrocarbons; 8 sulphureted hydrocarbons, and 20 nitrogenized compounds of carbon, oxygen and hydrogen.

An impurity of this nature is removed from the gases as early in the process of purification as possible, on account of its uselessness as a light-giver, interference (by stoppages) with the functions of other succeeding apparatus, its incapability of being distributed, and its commercial value. In stating that tar is useless from a light-giving standpoint, the fact is not overlooked that thin tars are frequently employed for enriching purposes; but, when so used, they are further distilled and redivided into hydrocarbon gases and heavier tar. The amount of tar found in the various gases is tabulated below:

	By Weight. Per Cent.	Gals. Per M. Cu. Ft.
Coal gas	4 to 22	.7 to 1.4
Coke or coal water gas	5 to 20	.5 to 1.5
Lampblack water gas	7 to 22	.5 to 2.5
Crude oil gas	10 to 30	.2 to 3.0

This comparatively wide range of figures is due to the many compositions of tar, as influenced by the different constituents of the many coals and oils in use, as well as by the varying temperatures maintained in the generating apparatus. Calculations for the above data, as a check on reported practice, were based, in the case of coal gas, on 9 to 16 gallons of tar per ton of coal carbonized—tar of from 1.08 to 1.175 specific gravity; for water gas, on from 20 per cent. to 24 per cent. of the oil used—tar of 1.05 to 1.075 specific gravity; and for crude oil gas, on a heat balance between the oil entering the generators and the gases, byproducts, wastes, etc., delivered from the apparatus; also by actual measurements in various plants. An allowance for a 5 per cent. possible error in either direction has been made.

Tar, as it appears in gas before entering the primary sealing devices, is in the form of mist or vapor, minute globules being suspended in and carried along with it. When this tar-mist first comes in contact with water in the hydraulic mains or wash boxes, from 30 per cent. to 40 per cent. of the tarry particles is precipitated; the balance is removed in condensers, scrubbers, or extractors especially equipped for the purpose.

A flow of from 10 to 15 gallons of water per 1,000 cubic feet of gas passed in the washbox of a water gas set, from 25 to 30 gallons for oil gas, and from 5 to 12 gallons per 1,000 cubic feet of coal gas passed in the hydraulic mains is sufficient to take out the above quantities of tar. Pumping capacity for at least 15 per cent. more water should be provided, however, to take care of excess amounts of tar.

Two principal types of condensers are in use at the present time, the operation of which relies on cooling the gas to, or slightly below, atmospheric temperature, at which point practically all tar is precipitated.

The oldest form (atmospheric condenser) depends for its cooling quality on the transmission of heat of the gas from the interior of a series of metal pipes (in which the gas is flowing) to the surrounding air. From 5 square feet to 7 square feet of cooling area, per 1,000 cubic feet of gas passed per 24 hours, should be provided for the proper condensation of tarry vapors. Ample provision for cleaning these pipes is usually made.

The second type is the water condenser, wherein the gas either passes through a series of tubes surrounded by water or around tubes through which water is flowing. This style is more economic of ground space than the atmospheric type, requiring but 3 square feet to 4 square feet (per 1,000 per diem) of cooling surface for water or coal gas containing a small percentage of tar, or 4.5 square feet for coal gas rich in tar.

Salt or fresh water is used equally well in tubular condensers, the determining element being the cost of supplying water. In some

plants, where fresh water is cooled and repumped for washing and condensing purposes, the condensed water vapor from the gas is often collected from various points in the plant and utilized to compensate for the losses by evaporation, leakage, etc.

It may be well at this point to state that, for the proper extraction of the numerous impurities in gases, found between the generating system and the sulphur removing apparatus, it is essential that the temperature be reduced gradually from the starting point, being stepped down a few degrees in each succeeding part of the system. The greatest drop (not over 60° F.) should occur in the condensers.

Sudden chilling is not only injurious to the lighting and heating properties of the gas, by throwing down desirable hydrocarbons, but it tends to deposit tar, naphthaline and water at unwished for points. The action of a tar extractor, used in some plants in conjunction with a condenser or scrubber, or made to perform the work of tar elimination alone, is dependent on the principle that subjecting a crude gas to "wire-drawing" will throw down the suspended tarry globules. Most of those in use are identical with, or similar in construction to, the well known "P. & A." scrubber. In this machine gas is forced through a series of minute orifices, $\frac{1}{16}$-inch (or less) in diameter, which process effectually squeezes out the tar. Enough of these small holes are automatically presented to the gas flow to care for an increased or decreased quantity of gas.

Another extractor, similar in principle, but markedly different in construction, has recently appeared on the market. A mechanically driven drum, containing fine, close-set wire spokes, is inserted in the gas system where it is desired to remove tar. The gas is forced through the small interstices between these spokes, traveling in a spiral course and leaving the tarry matter behind. Suitable drums, containing casing and tar-draining devices, are provided. As in the case of condensers, extractors are unsuited for tar elimination from crude oil gas, owing to its extreme viscosity. For this purpose scrubbers, not unlike an ammonia tower scrubber, are employed. They consist of large iron or wood cylinders filled with checkerbrick, coke, wooden balls or gridlike trays of wood boards or slats, over which cool water is sprayed. The gas in passing upward over these wetted surfaces is both gradually cooled, as in a condenser, and scrubbed, as in an extractor, thus depositing the tar which is carried off from the bottom with the washing water.

For oil gas there are, in some cases, three or four of these scrubbers required in series for the complete separation of the tar. From 30 to 50 gallons of water in each scrubber per 1,000 cubic feet of gas passed is the quantity usually required for good operation.

To assure that the gas will be totally free from tar (this is absolutely essential) before entering the sulphur-extraction apparatus or purifiers, scrubbers containing dry shavings or excelsior are interposed in the flow of gas after the regular condensers, extractors or scrubbers. Dry, coarse shavings are preferable, since they do not clog as easily as fine or moist shavings or sawdust. For economic renewal, and to prevent packing, shavings are usually supported on numerous trays in shallow layers not over 2 feet deep. There is seldom more than 2 per cent. of the total quantity of tar originally in the gas, removed by shaving scrubbers. As an economical expedient, the tar thrown down in condensers, extractors or scrubbers should not remain long in contact with the gas because of its liability to rob it of its true illuminants.

A simple test for the quantity of tar present in crude gas can be made by passing a volume of gas through a known weight of closely packed cotton, afterwards drying the cotton at 100° C. and reweighing. The gain in weight divided by the cubic feet of gas passed, and multiplied by 1,000, will give the quantity of tar per 1,000 cubic feet. Ammonia, a gas NH_3, or in its aqueous state NH_4OH, is found in large quantities in coal gas and in only slight amounts in water gas or oil gas. It is formed directly from the destructive distillation of nitrogenous substances contained in bituminous coal. The almost negligible presence of it in the other two mentioned gases is due to the presence of nascent hydrogen and nitrogen which will unite while in that state in the proportion of three to one.

There are two prime reasons for extracting ammonia from coal gas:

First; its commercial value in the form of ammoniacal liquor from which it is derived; bi, mono and sesqui ammonium carbonates, and ammonium sulphide, ammonium hydro-sulphide, ammonium cyanide. ammonium acetate, free ammonia, ammonium sulphate, ammonium thio or hyposulphite, ammonium thiocarbonate, ammonium chloride, ammonium sulphocyanide, ammonium ferrocyanide.

Second; because of its deterious effects on metal apparatus of gas manufacturing and distributing systems. Between 300 and 800 grains of ammonia per 100 cubic feet (approximately 15 per cent.) may be present in the gas at the entrance to the hydraulic main.

Ordinary fresh water—the agent for its removal—has the following absorbing powers: One volume of water will absorb

At 32° F.	...	1,050	vols.	of ammonia
" 50° F.		813	"	" "
" 60° F.		727	"	" "
" 68° F.		654	"	" "

but at ordinary temperatures (from 60° to 70° F.) due to the presence of other gases with ammonia, water will take up only 100 to 150 grains of NH_3.

By passing gas through the seals of hydraulic mains, and later through cool water or water mist, or in contact with water-wet surfaces in especially constructed washers, it will be entirely freed from ammonia.

Several "freak" processes have been introduced whereby acids are employed to take out ammonia, but their installation and maintenance are very expensive compared with the water purifying type. The history, types and structural details of ammonia washers and scrubbers are too numerous to discuss here. They vary from the tower scrubber in its various phases to the more modern mechanically operated washers.

The tower scrubber is usually filled with coke or wood trays, wetted by water sprayed in from the top; gas passing upward from the base. With wooden trays in use, at least 5 cubic feet of internal space should be allowed per 1,000 cubic feet per day, based on the maximum production. Newbigging advises the provision of 9 cubic feet per 1,000, but with efficient trays and sprays this is a trifle high. About 4 gallons of water are required per 1,000 cubic feet of gas scrubbed; the amount varying somewhat with temperature conditions, and the degree of foulness of the scrubber.

The mechanically operated rotary washers, with their infinite number of clean and freshly wetted surfaces, are fast supplanting the tower and similarly antiquated types, in which the gas was allowed to seek its own unaided path, and wherein the removal of ammonia was not always complete, because of their positiveness in ridding gas of this impurity, their low cost of mainte nance, saving in ground space, economic construction and ease of operation.

In the rotary washer, the semi-submerged rotating element is usually composed of a series of brushes (fiber), loosely-laid, perforated iron sheets, or close set narrow wooden slats, through which the gas has to travel a definite tortuous course between the innumerable wet surfaces. A maximum of 2 gallons of water is necessary per 1,000 cubic feet, although, with gas comparatively free from tar and water at 60° F. to 62° F., one gallon will suffice, making caustic liquor of approximately 20-ounce strength; ounce strength being the number of ounces of 1.84 specific gravity sulphuric acid that will neutralize all the ammonia in one gallon of 2,150 cubic inches of liquor. In hydraulic mains from 20 per cent. to 40 per cent. of the total ammonia is removed. This "weak liquor" contains no free ammonia, but rather its soluble salts.

A simple test for ounce-strength of ammoniacal liquor can be made by using a Twaddell hydrometer, each degree thereon being equivalent to 2 ounces of 1.84 gravity sulphuric acid required to neutralize the ammonia contained in an English gallon. A divisor of 1.2 will convert the result into the U. S. Standard.

The presence of ammonia, even in small quantities, can be detected quickly by allowing gas supposed to contain it impinge on a piece of absorbent paper moistened with a solution of turmeric root. A change from yellow to red-brown shows the presence of alkali gases. Lampblack, which we know as the carbonaceous by-product of crude oil gases generated at comparatively high heats, consists of pure black carbon intermingled with a small quantity of dead oils and impurities from the removing vehicle—water, either fresh or salt. The following analyses of lampblack are from gas made with 18° to 20°, Be°: Whittier oil.

	No. 1.—Lampblack Leaving Washbox. Per Cent. by Weight.	*No. 2.—Lampblack Stored 2 Weeks.* Per Cent. by Weight.
Moisture	72	52
Volatile matter	8	5
Fixed carbon and ash	20	43

	No. 3.—*Lampblack 1 Month Old.* Per Cent. by Weight.	No. 4.—*Lampblack 1 Month Old Containing Large Amount of Tar.* Per Cent. by Weight.
Moisture	41.2	8.8
Volatile matter	9.5	22.4
Fixed carbon	49.1	68.2
Ash	.2	.6

The writer takes the liberty of quoting the two following analyses made in San Francisco, where 14° to 15° Be. oil was employed:

	No. 1.—*Containing a Small Amount of Moisture.* Per Cent. by Weight.	No. 2.—*Dry Lampblack.* Per Cent. by Weight.
Moisture	8.5	0.0
Volatile matter	10.8	43.15
Fixed carbon	79.9	65.80
Ash	.8	.05

It is present in large quantities in crude oil gas and, but slightly, if ever, in water gas; its formation in the latter being avoided rather than cultivated.

The amount produced in the manufacture of crude oil gas is dependent on two chief factors: First, the percentage of carbon contained in the oil used; and, second, the degree of heat encountered by the oil in the generators. This amount varies with the above conditions from 12 pounds to 25 pounds (dry) per 1,000 cubic feet manufactured. Experiments as an approximate check on these figures were made by bubbling gas from generator take-off pipes through a series of washbottles placed before a small meter; afterwards, filtering and drying the lampblack at 212° F.

Lampblack formation is due to the complete separation into elements of certain members of the hydrocarbon group of gases generated by the contact of oil with hot surfaces. Although unavoidable, and at times an objectionable by-product of crude oil gas, it is very valuable both as a fuel and as a basic carbon for the generation of water gas. For the former purpose 1 pound, containing 45 per cent. to 50 per cent. of moisture, is equal to .15 to .20 pounds of crude oil, having 19,000 B.T.U.'s per pound, and .25 to .33 pounds of coal averaging 12,500 B.T.U.'s per pound. Employed in water gas manufacture, with crude oil as the enriching agent, it has a capacity equal to about ⅓ that of good coke.

Naphthaline (C_{10} H_8) is a volatile hydrocarbon, formed in comparatively small quantities by distillation, at high temperature (*i. e.*, over 1,800° F.) of carbonaceous substance used in gas manufacture, such as coals and crude oils. It appears in coal and oil gas, usually owing to the employment of heats greater that 1,800° F., but seldom in water gas made from coke or anthracite coal, due to the working temperatures being lower. In the case of lampblack, water gas, naphthaline may appear if oil gas tar is present in the lampblack fuel used. This tar contains a certain amount of naphthaline which it absorbed in the scrubbing apparatus and which is liberated under the influence of the fuel bed heat. Absolutely pure naphthaline is a highly voluminous crystaline, solid at from 45° F. to 60° F. Its vapor tension is such that approximately the following quantities may be carried by a saturated gas:

Temperature, Degs. F.	Grains per 100 Cu. Ft. Gas.
60	12
80	39
100	115
120	279
140	632
160	1,442

Inasmuch as coal and crude oil gas at generation contain far greater quantities than would saturate them at normal distributing temperatures, the necessity of removing naphthaline to avoid stoppages (by its dropping out and crystallizing) in the works apparatus, mains, services, meters, etc., become paramount. Its elimination from coal gas up to the present time is accomplished in two ways:

First: Used particularly in connection with low candle power coal gas, it is cooled suddenly in one of two twin condensers, to a point somewhat lower than it is expected to reach thereafter. All naphthaline down to saturation point at the temperature reached is deposited. The balance will safely be carried on in the form of gas.

The tar thrown down in the same apparatus will absorb approximately 5 per cent. of the naphthaline. When one condenser becomes fouled it is cut out of service and steamed, the companion condenser replacing it. Another method is to run sufficient thin water gas tar or crude oil into the first two or three compartments of mechanical ammonia scrubbers to absorb the excess of naphthaline.

Oil gas practice tends toward the adoption of oil scrubbers wherein reasonably thin oil is sprayed over a series of trays (within the scrubber shell) through and about which the incoming gas is forced in a tortuous passage. This oil has a capacity for absorbing hydrocarbon gases and, besides removing naphthaline, may take out other luminous constituents to the detriment of candle power amounting from 1 per cent. to as high as 5 per cent. loss.

From 10 to 25 per cent. crude oil, per 1,000 cubic feet of gas passed, is sufficient to eliminate the average amount of naphthaline found in oil gas, providing the gas entering the scrubber is below 100° F.

While this system effectually removes the naphthaline, there is a tendency, if light oils are used (over 16° Be.), for the gas to pick up the higher oils as vapor which later condenses out in exhausters, purifiers, mains and services, causing almost as much annoyance and expense as the naphthaline whose function it is to remove. This trouble may be partially avoided by the interposition of shaving scrubbers after the oil scrubbers.

Owing to the dampening effect of oil scrubbing on candle power and heating value, it should only be resorted to when the expense of maintaining a given illuminating and thermal standard is less than the cost of such scrubbing, plus the cost of keeping mains and services free from naphthaline, in case oil scrubbing was not employed. Continuity of service should, however, be the guiding factor.

Even with the best of precautions in coal or oil gas plants, naphthaline may at times escape from the works in annoying quantities (due to inadequate apparatus, improper use of, or interruption in, the use of such apparatus), but if care is taken not to subject the gas to a "wire-drawing" effect in mains or services (brought on by small orifices, burred and rough connections or projections within the pipes) or to a too sudden decrease in temperature, by placing piping and meters in positions exposed to cold draughts, or dampness, the number of naphthaline complaints can be materially lessened.

The simplest test for naphthaline is to pass a known quantity of gas through picric acid, determining by titration the quantity of naphthaline-picrate formed.

Carbonic acid gas or carbon dioxide (CO_2) is present in coal gas to the extent of 800 to 1,500 grains per 100 cubic feet in carbureted water gas (made from coke or anthracite coal or lampblack) from 1,500 to 4,500 grains per 100 cubic feet, and in crude oil gas from 400 to 1,400 grains per cubic foot.

It is partially a product of destructive distillation of coal and oils, and partly due to the actual combustion of carbon under the influence of liberated oxygen in retorts or generators. In coal gas benches, where a high vacuum is maintained on the hydraulic main, carbon dioxide may be drawn through cracks in the retorts from the setting.

Being a diluting (not a combustible) constituent of illuminating gas it is objectionable when present in such quantities as to affect the illuminating or heat values to any great extent. Candle power is decreased from .7 to .8 candles, and the thermal capacity from 13 to 17 B.T.U.'s per cubic foot for each 1 per cent. of CO_2 present between ½ per cent. and 4½ per cent., after which the dampening effect varies.

Experiments to establish these figures were made separately on water, oil and coal gas, by filling one of two interconnected, 10-foot meter provers with gas (from which all CO_2 had been removed by passing through lime water and weak caustic soda solutions) and adding pure carbonic acid in ½ per cent. quantities, as near as possible. The gases were thoroughly mixed by forcing them, from one meter prover to the other, 10 times. From the provers it was piped to a bar photometer and calorimeter, where an average sample for analysis purpose was taken during the candle power and thermal tests. The CO_2 used was the commercial liquefied acid, and was released slowly from its containing cylinder into the meter provers through a small wet meter. Its removal is not ordinarily attempted, nor would it be practical except in such cases where the process of elimination was cheaper than the additional oil used to maintain the candle power and heating value to the proper standard.

Slaked lime Ca $(OH)_2$ has a strong affinity for CO_2, forming calcium carbonate ($CaCO_3$) and water, which, under the old lime purication system, was extremely annoying, due to the caking of calcium carbonate with its attendant back pressure. A plan for freezing gas from carbonic acid in conjunction with sulphur compounds will be referred to later on.

A quick test for the percentage of CO_2 in gases can be made by the use of a Hempel caustic soda pipette and measuring tube; 100 parts

of gas, at atmospheric pressure and temperature, are subjected to the action of caustic soda and the difference made by absorption read directly in percents of CO_2 originally present.

Cyanogen, a colorless gas C_2N_2, is sometimes found in coal gas to the extent of 120 grains per 100 cubic feet, and in very minute amounts (scarcely more than traces) in oil and water gas. It usually asserts itself as hydrocyanic (or Prussic) acid (HCN) in combination with ammonia. Its removal is not fostered, except where it is present in large quantities, and where there is a market for the cyanogen compounds. It has a detrimental effect on purifying material which is at times very marked, but its absolute elimination is too expensive to be undertaken in ordinary gas works. This compound will unite with certain amounts of ferric oxide forming Prussian blue, rendering a portion of the purifying sponge unfit for the removal of sulphur compounds. Where it appears in small quantities cyanogen will be absorbed in the gas liquor in ammonia scrubbers forming ammonium cyanide. Special reagents (solutions of certain ferrous salts) have been used in especially constructed washers for the purpose, but the results have not been practical. The toxic effect of cyanogen is extremely bad.

A method for determining the amount of cyanogen in gas was published recently in the "Chemische Fabrik" (Frankfort A. M.) which is based on the converting of cyanogen into yellow prussiate potash by means of freshly precipitated ferrous hydrate (FeO,H_2).

(To be Continued.)

The Value of a Weight Balance in Coal Gas Manufacture.

[Prepared by Mr. C. J. Ramsburg (Philadelphia, Pa.), for the Seventh Annual Meeting, American Gas Institute, 1912.]

My subject is "The Value of a Weight Balance in Coal Gas Manufacture;" it perhaps might better have been called some notes on the use of such a balance. It would be an easy matter to make a paper on this subject a matter of mere academic interest, but it has been my idea, in putting the subject matter together, to avoid this, and to endeavor to bring out the facts in a manner to stimulate the interest of the practical operator. At the present moment there are many systems from which to chose if one is contemplating a new plant. These may be enumerated as follows:

Horizontal stop end retorts.
Horizontal through retorts.
Coke ovens using "poor" gas for fuel.
Horizontal chamber ovens, vertical flues, with and without outside producers.
Horizontal chamber ovens, horizontal flues, with and without outside producers.
Inclined chamber ovens.
Inclined retorts.
Vertical retorts, intermittent (two types).
Vertical retorts, continuous (two types).
Vertical retorts, intermittently continuous.

A selection from these systems must be made from many underlying factors, the determination being a result of a composite economic condition embracing them all:

1. Suitability of plant to local ground situation and environment.
2. Investment cost.
3. Elasticity of production.
4. Labor and upkeep cost.
5. Economic use of the coal returning the maximum value in total products.

It is easy to see that the selection of a type of plant must satisfy many conditions. That it develops the ultimate value in products while satisfying certain standards is, of course, an important point and the one first to be considered. It is to this question of ultimate value that this paper is concerned, though only in so far as the value of a weight balance may be concerned in reasoning toward that determination. Coal is:

"The solid degradation products of vegetable decay, together with such of the original bodies as have resisted to a greater extent the actions to which they have been subjected." (Vivian B. Lewes.)

As such, it is a composite of carbon, hydrogen, oxygen and nitrogen, with such minerals as have been combined in its structure and are disclosed as ash and as impurities in the gas. The matter which concerns us, however, is that it contains a mixture of hydrocarbons, and as such baffles chemical examination as to little but its ultimate composition. As a mixture of hydrocarbons, standards of value must rest on ultimate analysis together with proximate analysis, the latter, to be of value, being necessarily conducted under prescribed and standard condition of method. The examination of coal in this country is made by methods prescribed by the American Chemical Society, as follows:

"*Volatile Combustible Matter.*—Place one gram of fresh, undried, powdered coal in a platinum crucible, weighing 20 or 30 grams and having a tightly fitting cover. Heat over the full flame of a bunsen burner for 7 minutes. The crucible should be supported on a platinum triangle with the bottom 6 to 8 cm. above the top of the burner. The flame should be fully 20 cm. high when burning free, and the determination should be made in a place free from draughts. The upper surface of the cover should burn clear, but the under surface should remain covered with carbon. To find 'Volatile Combustible Matter' subtract the per cent. of moisture from the loss found here."

The examination in the laboratory of a well-known American coal will be reported as follows:

Ultimate Analysis.	Per Cent.	Proximate Analysis.	Per Cent.
Hydrogen	5.34	Moisture	1.20
Carbon	77.00	Volatile combustible	38.50
Oxygen	7.65	Fixed carbon	52.70
Nitrogen	1.27	Ash	7.60
Sulphur	1.10		
Ash	7.60		

Let us consider these analyses from the basis of a short ton of coal, 2,000 pounds, the same being used as a practical working standard and for reasons of mental grasp.

Two Thousand Pounds Coal.

Ultimate.	Pounds.	Proximate.	Pounds.
Hydrogen	106.80	Moisture	24
Carbon	1,540.00	Volatile combustible	770
Oxygen	153.00	Fixed carbon	1,054
Nitrogen	25.40	Ash	152
Sulphur	22.00		
Ash	152.00		

A comparison of these two at once discloses that by this method of analysis, while there are 1,540 pounds of carbon in the coal ultimately that by distillation in the method prescribed there are but 1,054 pounds (proportionately) remaining in the crucible, and that 486 pounds have been driven off in gaseous form. With this same coal a variation in the method prescribed will give entirely different results, and will show that the relation between the fixed carbon and the ultimate carbon is entirely a matter of method, and that the proximate analysis is only of value when made under standard conditions. In other words, if the coal be heated for a longer time at a lower heat, or for a shorter time at a higher heat, the results will disagree greatly.

When in actual practice we compare the results obtained with the proximate analysis, we are more and more convinced that the amount of fixed carbon is a matter of method, and that the amount of carbon remaining in the coke or the amount driven off in volatile products is a question of treatment.

Considering again the ultimate analysis, we find that, in a ton of this American coal, there are 153 pounds of oxygen. The oxygen appears ultimately in 3 products—water, carbon monoxide and carbon dioxide; a small quantity is left in the ash of the coke and in the tar, but they are so small as to be almost negligible. The fact remains, therefore, that in the amount driven from the coal as volatile combustible there is a considerable amount of water (formed by an association with hydrogen) carbon monoxide and some carbonic acid. (See paper by Porter and Ovitz, American Gas Light Journal, Sept. 14, 1908.) In the coal in question this amounts to about 130 pounds of water and about 20 pounds CO_2, but will, of course, vary with the CO produced. It will be seen, therefore, that the amount of "volatile combustible" formed as shown by the proximate analysis, namely 770 pounds, must be reduced by the amount of water and carbonic acid formed, and that the amount of fixed carbon remaining as coke will be a function of the treatment of the coal, and will vary according to the extent to which the breaking up of the hydrocarbons is carried. It will also be very plain that the amount and quality of the hydrocarbons driven off in the gas will vary accordingly.

In the disassociation of the hydrocarbons and the "cracking" a considerable quantity of free carbon is formed, which is carried along with the gas. In all forms of carbonizing chambers, where the gas is forced to pass through the coal and coke, this is largely left in the coke; in such forms where the gas passes over the coal and coke in open space, of large or small extent, some of this carbon is either de-

posited in the stand pipes and mains or thrown down in the tar. By referring to the tar charts in the appendix this fact will be clearly seen, and will be referred to later in this paper when the tar charts are discussed.

The amount of disassociation and the character of the breaking down of the hydrocarbons are a function of the temperature that the gas attains. Nearly all coal gas processes indicate the effect of too high temperature on the gas after is is driven from the coal. Nearly all of the rich illuminating ingredients of gas are degraded in being heated to a temperature of 1,400° F. In connection with this matter of treatment, the subject can best be made tangible and concrete by drawing an analogy to conditions existing in the gasification of hydrocarbons from the carburetting material used in water gas manufacture.

The electric pyrometer has established the fact that, with all oils in ordinary use, whether made up of the fat paraffine hydrocarbons of the Lima and Pennsylvania districts, or the lean naphthenes and asphaltic base compounds of Texas, Russia and Borneo, or the mixed base oils of Oklahoma, that the heats to which the oil is subjected and finally attains in the superheater lies for best efficiency in very narrow limits, and in the neighborhood of 1,300° F. With any oil, 1,400 F. will cause a falling off in efficiency, and the same is true if the heat be dropped to 1,200°. Consider, if you will, two water gas analyses made with all other conditions the same, the heat being in one instance 1,250°, and the other 1,350°.

Carburetted Water Gas.

Heat at Base of Superheater.	"A" 1,250° F. Per Cent.	"B" 1,350° F. Per Cent.
Illuminants	13.6	12.0
Carbonic oxide	31.2	30.7
Hydrogen	34.9	34.0
Marsh gas	8.9	13.0
Ethane	3.9	3.2
Carbonic acid	3.6	3.4
Oxygen	0.2	0.2
Nitrogen	3.7	3.5

From the oil, therefore, we have:

	Feet.	Feet.
Illuminants	136	120
Marsh gas	89	130
Ethane	39	32

(No allowance made for H.)

Or, on an oil gas basis:

	Per Cent.	Per Cent.
Illuminants	51.5	42.6
Marsh gas	33.7	46.1
Ethane	14.8	11.3

It will thus be seen that a change in heat of 100° make a material change in the composition of the oil gas. If this be true in a water gas set, how much more must be the variation in the structure of the hydrocarbons as accomplished in the various methods of treating coal gas, where the heats vary to a greater extent? This effect of disassociation by treatment, and an idea of the extent to which the study of heating effects can be carried, is best illustrated by making weight balances, and following the final products on some particular coal gas plants that have been the subject of careful study.

In the winter of 1911 it was necessary for me to make a test of a plant of intermittent vertical retorts at Manchester, New Hampshire. Great care was taken to secure accurate results, and it was when preparing the data for a report on this test that I made my first attempt at an ultimate weight balance. The data of the test were as follows:

Coal Used: West Virginia, ¾-Inch Screened. Average Analysis:

Proximate.	Per Cent.	Ultimate	Per Cent.
Moisture	1.3	Hydrogen	5.37
Vol. comb	39.2	Carbon	76.00
Fixed carbon	51.1	Oxygen	7.68
Ash	8.4	Nitrogen	1.29
Sulphur	1.38	Sulphur	1.38
		Ash	8.40

Results: Gas per short ton (corrected), 11,180 cubic feet; specific gravity, 0.44.

Candle power	13.47 flat flame.
B.T.U.'s	600
Dry tar	14.14 gallons.
Specific gravity of tar	1.1443
NH_3	6.17 lbs. per net ton.

Weighed coke: Dry (and hot), 67.5 per cent., 3 days' test; all coke weighed. Analysis of coke:

Vol. comb	1.56 per cent.
Fixed carbon	87.12 "
Ash	11.32 "

Analysis of gas:

Illuminants	4.4 per cent.
Carbonic oxide	7.4 "
Hydrogen	50.7 "
Marsh gas	27.5 "
Ethane	2.0 "
Carbonic acid	2.0 "
Oxygen	0.5 "
Nitrogen	5.5 "

Using these data as a basis, the accomapanying weight balance was deduced. It is not claimed that this has not certain factors whose use is somewhat problematical; but it is as near correct as need be for purposes of reasoning, and is practically correct.

Making the balance in this manner, while based on insufficient data in some places, was nevertheless instructive and brought out some interesting points.

1. While the gas obtained contained nearly 51 per cent. of hydrogen, the total amount produced was but 1.5 per cent. the original coal.

2. While the proximate analysis of the coal showed 1,022 pounds of fixed carbon, there was accounted for

In coke	1,176.00	Total of 1,183.52 pounds.
In tar	7.52	

or a gain of 161.52 pounds. This must have come from a disassociation of the volatile combustible.

3. The volatile combustible from the proximate analysis showed, in 2,000 pounds, 784 pounds. Of this we can account for

	Pounds.
As water of formation	106.06
As gas	376.01
As tar	134.30
As NH, and S	20.00

a loss of 147 pounds.

Here, then, was a plant getting almost the best results in total products of which we have knowiedge, and the showing was such that, from what might bn termed the possible volatile (*i. e.*, the volatile combustible 784 pounds less 123.43 pounds water or 660.57 pounds,) 147 pounds, or nearly 19 per cent., is dissociated into its elements. Of course, no hydrocarbons can be "broken down" without the formation of some carbon, but this seemed a heavy toll to pay.

This weight balance at Manchester, New Hampshire, proved so interesting that it seemed of further interest to make up another one on another kind of a plant for purposes of comparison. Fortunately there had been a paper read before the Institute 3 years ago, which contained data on this subject. Namely, "A Pound of Coal," by Mr. Charles Dudley Lamson, concerning the operation of a plant in Worcester, Massachusetts, of through horizontal retorts of special design and construction.

General Comparison between Ultimate Weight Balance at Worcester with Pennsylvania Coal, and Manchester, New Hampshire with West Virginia Coal.

2,000 Pounds Coal.	Pounds. Worcester.	Pounds. Manchester.	Per Cent. Worcester.	Per Cent. Manchester.	
Gas:					
Water	129.83	123.43	6.49	6.17	
Illuminants	74.85	60.35	3.75	3.02	
CO	59.92	61.28	2.99	3.06	
H.	31.76	30.04	1.58	1.50	
Paraffines	174.80	147.90	8.74	7.39	
CO_2	15.24	26.02	0.76	1.30	
O_2	—	4.73	—	0.02	
N	15.24	45.69	0.76	2.28	
Tar.					
0 to 100° C.		1.45		0.07	
100 to 135° C.					
135 to 170° C.	69.83	1.20	127.27	3.49 0.06	
170 to 200° C.	1.55	5.90	0.07	0.29	6.35
Above 200° C.	68.28	118.72	3.42	5.93	
Free carbon	39.38	7.52	1.99	0.37	
Coke:					
Vol. Comb	24.01	21.00	1.20	1.01	
Fixed carbon	1,171.00	1,176.00	58.55	58.80	
Ash	1.40.00	152.80	7 .00	7.64	

The Worcester figures make a weight balance in the same general plan as Manchester. In this it was necessary to assume that the gas

Manchester Weight Balance.

2,000 pounds coal:

Per Cent.	Pounds.
Moisture... 1.3 =	26
Vol. comb..39.2 =	784
Fixed carb.51.1 =	1,022
Ash..... 8.4 =	168
Accounted for	2,003.74
Less extraneous nitrogen.....	22.89
	1,978.85

		Per Cent.	Feet.	Pounds per Foot.	Total Pounds.	Per Cent. of Coal.		
Water	Moisture less water vapor in gas at meter.		26 less 9.17		16.83	123.43	6.17	
	Water of formation.				106.60			
Hypothetical illuminants.	Benzene	1.0 =	111.8	0.2064	23.08		1.15	
	Ethylene....	1.2 =	134.0	0.0741	9.03		0.59	
	Propylene..	2.2 =	246.0	0.11115	27.34		1.37	18.57.
Gas, 11,180 × (0.44 × 0.07658) = 376.01	CO.....	7.4 =	827.3	0.07407	61.28		3.06	
	H_2.....	50.7 =	5,668.3	0.0053	30.04		1.50	Some extraneous nitrogen.
	CH_4.....	27.5 =	3,074.5	0.04234	130.15	147.90	7.39	
	C_2H_2.....	2.0 =	236.6	0.0794	17.75			
	CO_2.....	2.0 =	223.6	0 11637	26.02		1.30	
	O_2.....	0.5 =	55.9	0.08463	4.73		0.02	
	N_2.....	5.5 =	615.0	0.07429	45.69		2.28	
		Per Cent.	Pounds.					
Tar, × (14.14 × (1.1443 × 8.3) = 134.30	Up to 100° C. / 100 to 135° C.	1.08 ×	134.3	1.45			0.07	
	135 to 170° C.	0.90 ×	134.3	1.20		127.27	0.06	6.35
	170 to 200° C.	4.40 ×	134.3	5.90			0.29	
	Above 200° C.	88.40 ×	134.3	118.72			5.93	
	Free carbon	5.60 ×	134.3	7.52			0.37	0.37
Coke.....1,350.00	Vol. comb.....	1.56 ×	1,350	21.06			1.05	
	Fixed carbon ..	87.12 ×	1,350	1,176.12			58.81	67.50
	Ash	11.32 ×	1,350	152.82			7.64	
NH, and sulphur.....20.00								

Worcester Weight Balance.

2,000 pounds coal:

Per Cent.	Lbs.
Moisture..... 1.3 =	26
Vol. comb.....34.5 =	690
Fixed car.....57.1 =	1,142
Ash ..... 7.1 =	142

Results at Worcester:

Yield per short ton, 11,900 cu. ft.; specific gravity, 0.44.

Coke assumed 1,334 pounds in Mr. C. D. Lamson's paper.

		Per Cent.	Feet.	Lbs. per Ft.	Total Lbs.		Per Cent. of Coal.
Water	Moisture less water in gas at meter.....	...	26 less	9.17=	16.83	129.83	6.49
	Water of formation.....	...	565	....	113.00		
Hypothetical illuminants..	Benzene.....	1.0 =	119	0.2064	24.57		1.23
	Ethylene.....	1.2 =	143	0.0741	10.60		0.53
	Propylene	3.0 =	357	0,11115	39.68		1.99
Gas, 11,900 × 0.44 × 0.07658 = 401 pounds	CO	6.8 =	809	0.07407	59.92		2.99
	H_2.....	50.2 =	5,974	0.0053	31.76		1.58
	CH_4.....	34.7 =	4,129	0.04234	174.80		8.74
	CO_2.....	1.1 =	131	0.11637	15.24		0.76
	O_2.....	...	.....	.....	....		....
	N_2.....	1.7 =	202	0.07429	15.24		0.76
Tar, 110 pounds	0 to 100° C. / 110 to 135° C. / 135 to 170° C. / 170 to 200° C.	1.23 of 110			1.35		0.07
	Above 200°	62.07 of 110			68.28		3.42
	Free carbon.	35.80 of 110			39.38		1.99
		Pr. Ct.					
Coke	Volatile.....	1.8 × 1,334			24.01		1.20
	Fixed carbon.....	87.8 × 1,334			1,171.00		58.55
	Ash.....	10.5 × 1,334			140.00		7.00

samples given represented average samples of the gas produced during the test, as also specific gravity determinations. The tar sample was that secured from Worcester some time after the test, but the assumption of correctness is not far enough wrong to cut any figure.

An inspection of this comparison discloses some remarkably interesting data. From a coal, not so rich in volatile constituents, produced, by through horizontal, retorts, 14.50 pounds more illuminants, or nearly 24 per cent. more than vertical retorts. There is also an increase of 26.90 pounds of paraffines, or 18.2 per cent. more. A further inspection shows that this increase of 40.81 pounds of hydrocarbons has been apparently made from what would have appeared as *tar oils*. The ton of coal in the verticals formed 127.27 pounds of tar oils; the horizontals but 69.51, a difference of 57.76 pounds, so we may deduce the conclusion that the very high results at Worcester are due to a system which disassociates what would go into tar oils into illuminants and paraffines. An examination of the Worcester report shows that the amount of coke formed was assumed as being:

"Coal minus the volatile matter in the coal, plus the volatile matter in the coke, equals coke."

That is, in this instance, 1 — 0.3503 + 0.0176, = 66.7, or on a short ton basis 2,000 — 700.6 + 35.20 = 1,334 pounds.

This assumption was doubtless arrived at after some experiment, but it is not true in any other coal gas plant that I can discover, and practical confirmation is lacking. In order to check this I requested a larger plant, operating a very similar installation, to make a careful investigation of this phenomena. These results are as follows:

TEST SHOWING THE FIXED CARBON AND ASH IN COKE FROM A CHARGE OF 1,350 POUNDS OF COAL.—*Horizontal Retorts.*

	Coal Analysis, Per Cent.	Coke Analysis, Per Cent.
Moisture.....	0.97	5.18
Volatile matter.....	33.76	0.87
Fixed carbon.....	55.98	81.30
Ash.....	9.29	12.65
	100.00	100.00
Sulphur.....	0.99	0.00
Weight of coal charged.....	1,350 pounds.	
Length of charge.....	7 hours.	
Dry coal.....	1,337 pounds.	
Dry coke.....	988 pounds.	
Per cent. of dry coke to dry coal..	73.9	

Coal Content.	Pounds.		Pounds.
Volatile matter.....	1,350 × 0.3376	=	455.76
Fixed carbon	1,350 × 0.5598	=	755.73
Ash.....	1,350 × 0.0929	—	125.42
			1,336.91

Coke Content.	Pounds.		Pounds.
Volatile matter	1,042.50 × 0.0087	=	9.07
Fixed carbon.....	1,042.50 × 0.8130	=	847.55
Ash.....	1,042.50 × 0.1265	=	131.87
			988.49

Accounted for in Coke.

		Per Cent.
Free carbon	847.55 ÷ 755.73	= 112.15
Ash	131.87 ÷ 125.42	= 105.14
Total	979.32 ÷ 881.15	= 111.14

This plant secured 73.2 per cent. of coke; on the Worcester basis they would have secured 66.8 per cent., or a difference of 118 pounds coke.

The Manchester plant showed an increase in coke yield of 11.0 per cent. over the crucible determination; the other horizontal plant, 9.45 per cent. Worcester reports no increase whatever. Even if the increase at Worcester were but 3 per cent., the amount of weight added to the weight balance coke (40.02 pounds) would mean, to compensate the weight, a lowering of the tar yield 4 gallons, or a lowering of the specific gravity of the gas from 0.44 to 0.39, which would be a gas of much poorer quality than the report shows. Were the increase the same as in the other horizontal plant, the falling off in gas and tar would be so great as to make the suggestion untenable.

TEST SHOWING THE FIXED CARBON AND ASH IN COKE FROM A CHARGE OF 1,050 POUNDS OF COAL.

Inclined Retorts.

	Coal Analysis, Per Cent.	Coke Analysis, Per Cent.
Moisture	0.97	0.26
Volatile matter	33.76	2.53
Fixed carbon	55.98	84.50
Ash	9.29	12.71
	100.00	100.00
Sulphur	0.99	0.85
Weight of coal charged	1,050 pounds.	
Length of charge	6 hours.	
Dry coal charged	1,040 pounds.	
Dry coke	761 pounds.	
Per cent. of dry coke to dry coal	73.1	

	Coal Content. Pounds.		Pounds.
Volatile matter	1,050 ×	0.3376 =	354.48
Fixed carbon	1,050 ×	0.5598 =	587.79
Ash	1,050 ×	0.0929 =	97.55

	Coke Content. Pounds.		Pounds.
Volatile matter	762.99 ×	0.0253 =	19.30
Fixed carbon	762.99 ×	0.8450 =	633.73
Ash	762.99 ×	0.1271 =	96.97

Accounted for in Coke:

		Per Cent.
Fixed carbon	644.73 ÷ 587.79	= 109.68
Ash	96.97 ÷ 97.55	= 99.40
Total	741.70 ÷ 685.34	= 108.22

At Worcester the fixed carbon in the coal was equal to 1,142 pounds; in the coke we find from the analysis 1,171 pounds, which would give an increase in the coke of 2.2 per cent., but it is drawing the point rather fine to attempt to reason from analyses which do not pretend quite such exactness or representativeness of identical conditions. The condition existing at Worcester is so radically different from what exists in other plants as to suggest careful redetermination for confirmation. The proper way to make this determination is to weigh out carefully a charge of coal, and sample by quartering. Having carbonized the coal as usual, catch the entire amount of coke issuing from the retort and weigh while hot; having allowed this to cool, it should be sampled with great care.

As this paper will be sent out in time to reach the superintendents of plants operating through retorts, I trust that this matter will be accorded attention and data submitted in confirmation or rebuttal.

The fact, as illustrated in these two weight balances, as to the effect of horizontal and vertical carbonization on the product, is well brought out. The horizontal retorts are not like many other such settings, but are specially constructed so as to give very even heating. The retorts are "filled" and a charging machine of such a design used so as to permit this; there is, nevertheless, a considerable quantity of gas space above the coal. That some of the gas travels through the coal is doubtless true, but by far the larger amount must travel across the top of the retort, and in so doing becomes very highly heated. That this process results in a disassociation of the tar oils into rich, permanent gases is a remarkable deduction, but we come to no other conclusion from the data. On the other hand, the vertical retort requires that a very considerable quantity of the gas shall pass through the coal, and it follows, too, that in this process much of the carbon formed shall be left in the retort as coke.

An unexplained feature of this whole matter is the question of naphthaline. There is a large quantity of naphthaline made and carried forward in the horizontal gas; there is almost none in the vertical gas. This has always been accepted as indicating that there is a much greater amount of naphthaline made in the horizontal retorts. When we consider the matter further, however, we are impressed by the thought that the reason the naphthaline is not evident in the vertical gas is because there is a much greater quantity of tar oils to keep it in solution; and we know, from work done by White and Clary (see AMERICAN GAS LIGHT JOURNAL, October 23, 1905), that these hot tar oils are excellent solvents for naphthalines. It would be most interesting, if the data were available, to make a comparison in naphthaline produced per ton of coal carbonized by the two processes.

In considering the coke yield, I make no argument with a purpose to prove the Worcester results wrong. It must be remembered that this plant is of special construction; that the method of heating retorts is a most efficient one for even heating; and that the device for charging the retorts is one that ensures an evenly filled retort. On the other hand, the fact is remarkable enough for a most thorough investigation, since this plant has set a standard for coal gas manufacture which so far outclasses the average plant as to make the latter seem entirely obsolete. No one can read Mr. Lamson's paper, and Mr. Dana Barnum's further remarks before the New England Association of Gas Engineers, without appreciating that the data in regard to results have been studied with great care for accuracy and clear understanding; but the coke yield is so at variance with our accepted ideas, that one can but wonder if some error has not been made—and I suggest a thorough re-examination.

I think you will agree with me that this setting forth of these weight balances is interesting, and that its use is likely to be of considerable practical, as well as academic, interest. In connection with a comparison of these two plants on this basis, it is to be regretted that two different coals were used, as the data would be more conclusive if the same coal were used on both plants.

The balances in this instance are open to some criticism from the standpoint of gas analysis, as the samples were probably not entirely representative of exactly average conditions, so that I wish to take opportunity of emphasizing the necessity of most careful gas sampling so as to get average samples. These weight balances encouraged an examination into other systems.

A weight balance was made, in a small way, on the stop-end horizontal 9's at Point Breeze, Philadelphia. In this plant the same coal was in use as at Manchester, New Hampshire. The balance disclosed some interesting features. This plant was securing the following results:

Yield	5.10	
Candle power	12.80	flat flame
Specific gravity	0.42	
Tar	11.60	gallons
Specific gravity	1.20	
Coke (weighed hot)	1,300	pounds

A balance from this shows:

Moisture, less vapor	17	pounds
Water of formation	121	pounds net
Coke	1,300	pounds
Tar 11.6 × 9.96 =	116	pounds
Gas 10.2 × 0.42 × 76.58 =	328	pounds
NH, and S	20	pounds
Total	1,902	pounds net

The interesting fact about this is that in valuable products this system shows an unaccounted for amount of 98 pounds per ton, while securing what would be reckoned in the general gas world as fair results on stop-end retorts. Some little of this 98 pounds can doubtless be accounted for in the amount of carbonaceous materials removed from the standpipes and hydraulic mains, but the fact remains there is this inefficiency in operation, and it is shown up in the weight balance. By making a careful test, the exact point of loss could doubtless be discovered.

To confirm this balance I had a weight balance made in the same way on a large stop-end plant outside of Philadelphia. This plant was accounting for 1,907 pounds in every ton, and represented results attained by the most careful supervision. That they were equally poor from a balance standpoint only confirms my judgment

(*Continued on page* 10.)

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NEW YORK, MONDAY, JANUARY 6, 1913.

[Official Notice.]

Joint Section Meeting, Illuminating Engineering Society and the National Commercial Gas Association.

New York City, 124 W. 42d St., January 2, 1913.

The New York Sections of the named Associations will hold a joint meeting at 29 West 39th street. the evening of Thursday, January 9, at 8:15 o'clock. Mr. R. F. Pierce, Illuminating Engineer of the Welsbach Company, will read a paper on "The Lighting of Taft Hall Auditorium-Armory, Atlanta, Ga." Members and guests are cordially invited to dine, *a-la-carte*, at Keene's Chop House, 44 West 36th street, at 6:30 P.M.

C. L. Law, Secretary, N. Y. Section,
Illuminating Engineering Society.

[Official Notice.]

Illuminating Engineering Society.

Illuminating Engineering Society, Office General Secretary, 29 West 39th street, Dec. 28, 1912.

The annual meeting of the Illuminating Engineering Society will be held at the Aldine Club, in the Fifth Avenue Building, 23d street, corner of Fifth avenue, New York city, Friday evening, January 10, 1913, at 6:30 o'clock. The meeting will be preceded by a dinner, the price of which will be $2.75, and in order that the Committee may know how many to provide for, you are requested to return early word if you intend to be present.

Very truly yours, C. Alfred Littlefield, Chairman.

[Official Notice.]

"Gas Meeters," Philadelphia Section, January Meeting.

833 Chestnut Street, Philadelphia, Pa., December 31, 1912.

The "Gas Meeters" and their friends in Philadelphia and vicinity are cordially invited to attend the second meeting, to be held Saturday, January 11th, at 6 P.M., at Kugler's Restaurant, 1412 Chestnut street. Very truly yours, H. F. Patterson, Jr., Secretary.

BRIEFLY TOLD.

Obituary Note, Henry Fayette Coggshall.—The Journal for the 23d ult. contained brief mention of the death of Mr. Henry Fayette Coggshall, who passed away, at his home in Fitchburg, Mass., the morning of December 15th, in the 89th year of his useful life. Born in Mansfield, Conn., December 26, 1823, after a primary teaching, supplemented by a partial course in the local High School, he engaged (1845) as bookkeeper for the Stoneville (Conn.) Cotton Mills, the (for those days) huge plant of which was located in Northville, Conn., and the proprietor of which was Col. Ivers Phillips, a noted capitalist and mill owner of Fitchburg, Mass. Col. Phillips tried hard to induce Mr. Coggshall to accept a similar position in the then Stone Cotton Mill—now the Cushing Grain Mill—Fitchburg, Mass. In 1850 he assented to the change, and later on became bookkeeper for the Putnam Machine Company. In 1852 he became connected with the Fitchburg and Worcester Railroad, a corporation that was also under the management of Col. Phillips, respectively serving it as ticket agent, freight agent and treasurer. In 1853 Mr. Coggshall became associated with Messrs. Phillips, Oliver Farwell and Geo. Odiorne (of Boston at the time) in the organization of the Fitchburg Gas Company. The estimated expenditure in connection with construction of these works was $40,000, of which sum deceased contributed about one-fifth. The contract for the works was awarded to Mr. B. R. Benedict (of Buffalo, N. Y.) who had just completed the plant for the Jamaica Plain (Mass.) Gas Company. Gas was turned into the mains December 15, 1853, and Mr. Coggshall, at the time, was constituted Agent of the Company, which title was subsequently merged into that of Treasurer, at about the time (1889) that the corporate title of the corporation was changed to that of the Fitchburg Gas and Electric Company. This title he retained up to the time (January 1, 1909) that the Tenney syndicate secured control of the properties. He was one of the earliest members (we believe since 1873) of the New England Association of Gas Engineers, and joined the American Gas Light Association at its meeting, May 13, 1874, and became a member of the American Gas Institute when the latter body succeeded to the estates of the former. He was a frequent attendant at the meetings, and had contributed two set papers to the proceedings of the New England body. While his activities were mainly connected with the artificial lighting industry, his association with banking, insurance, real estate and other manufacturing and business enterprises was decidedly extensive and varied. As a well-equipped purchaser of real estate he was exceeded by no other investor of Fitchburg. And much of the prosperity of that city is traceable to his methods. Amongst his notable gifts to the city is the magnificent public gathering place known as Coggshall Park. In 1906, he subscribed $10,000 to the building fund of the Y. M. C. A., which put the Association in ownership of its then new building clear of debt. He was also practically prominent in the religious circles of Fitchburg, and for 60 years was virtually at the head of the Calvinistic Congregational Church. His unrecorded good works are numberless. On December 10, 1846, he was united in marriage to Miss Sylvania Carpenter, and this union lasted until the death of the latter, May 3, 1904. Later on he married Miss Carrie L. Wilbur, who survives him. He was the last of his father's family. The funeral services were held in the Calvinistic Congregational Church, the afternoon of Wednesday, Dec. 18th, the Reverend James Chalmers officiating. Notable amongst the mourners was a large delegation from the New England Association of Gas Engineers, which body was also represented by a beautiful floral token. Interment was made in Forest Hill Cemetery. Deceased was known to the writer for 40 years, and it is the latter's privilege to testify to the personality of Mr. Coggshall that, keen business man though he was, his ways were those of probity, his practices were concomitant with gentleness, his principles were ever under the dominion of the Golden Rule.

CURRENT MENTION—

An entirely unexpected bit of news, coming to us by way of Boston, under date of the 2d inst., is to the effect that Mr. D. T. Cortis, for about 25 years owner and manager of the Appliance Department of the Boston Consolidated Gas Company, and the predecessor of the latter, is no longer connected with the establishment. His resignation and retirement became effective the 1st inst. Mr. Cortis will take a long recess from business or before deciding upon what his future work shall be. However, no matter what that eventual determination may be we, in common with about every one of the rank-and-file of New England's gas men, will join heartily in the hope and belief that, whatever he does, may that doing be successful in the highest degree.

"Mr. Arthur J. Smith, who has been with the Maquoketa (Ia.) Light and Fuel Company since 1907, took over the management of the Citizens Gas Company, of McCook, Neb., December 1st, 1912. Hardly any of the drummers who were there before, who look in on him now, may have to be directed to his headquarters. The reason for this uncertainty is that he has fixed up the Company's business headquarters in such style that even occasionally the home people are stumped for the moment to identify the old with the new.—R."

Under date of the 7th December last, that accomplished gentleman, Mr. M. Mizuta, Chief of the Tokyo (Japan) gas works, in renewing his subscription for the current year says, in conclusion, "I send

you good wishes and kind regards at this time." A salutation that we acknowledge with thanks, adding thereto that may his Company and himself enjoy to the full prosperity and ease.

"R. H. O.," writing from Atlantic Highlands, N. J., under date of the 1st inst., says, "That the Atlantic Highlands Gas Company has just been awarded a contract for the public lighting in Rumson borough, under which the Company will maintain twelve 500-candle power lights, and thirty-four 125-candle power high pressure lights. The Public Service Electric Company also bid for the entire contract, and did succeed in getting an award for all the 32-candle lights, the gas folks not being able to bid on a unit low enough to make competition possible." Naturally enough Manager Garrison feels quite elated over this outcome; in fact, he considers this incident as merely the entering wedge for the rapid extension of high pressure gas lighting in his Company's territory, remembering that the corporation has over 60 miles of high pressure mains serving a dozen small settlements that present great opportunity for the development of this modern method of public lighting.

"B.," WRITING from Oakland, Cal., under date of the 25th ult., says: "One of the prettiest wedding services ever witnessed in Oakland was that which marked the marriage of Mr. E. W. Lowe, prominent in the accounting division of the business of the Pacific Gas and Electric Company, San Francisco, to Miss Azalea Eleanor Snyder, of Sacramento. The ceremony was performed in the home of Mr. and Mrs. W. A. Caswell, 303 Newtown avenue, the Rev. George White, First Methodist Church, officiating. Mr. Earl J. Gates, of San Francisco, was best man, and the bridesmaid was Miss Ida Hoefer, of Secramento. They certainly made a charming pair, and if good wishes count for aught their union will be the happiest, forever and a day!"

"B. S. L., writing from Omaha, Neb., under date of the 26th ult., says: "Of course, I do not know what change may take place in the dickering—these are speedy days, noted for quick changes—but at this time of writing the agreement between the city of Omaha and the Omaha Gas Company, as at present constituted, may mean, for the next 10 years, a rate fixed at $1 (perhaps 95 cents) per 1,0000. Assistant City Attorney Lambert says that, in the consummation of this agreement, it is not contemplated that the Gas Company shall be given any assurance of an extended franchise, but would have the privilege, like any other franchise corporation, of appealing to the voters for an extension. Under the tentative agreement it is provided that, if the gas rate shall be fixed at $1 per 1,000 cubic feet, the Company shall pay to the city $45,000 annually, when the sales per annum shall be returned at 700,000,000; $50,000 when the quantities reach 800,000,000; $55,000 when the quantities reach 900,000,000; and $5,000 per annum for each additional 100,000,000 cubic feet increase. The sales in 1912 will amount to 775,000,000, and it is confidently predicted that the 800,000,000 mark will be reached in 1913. This straight royalty payment will supersede the present royalty and occupation tax of 5 cents per 1,000 cubic feet and 3 per cent. of gross earnings, respectively, which ruled since 1902. The yield from this amounted to $50,000 in 1912. It is stipulated, too, that in whatever agreement is reached, at no time shall the rate exceed $1 per 1,000 cubic feet. It is likely that an open meeting for everyone concerned will be called to consider the subject before anything permanent will be done."

MR. JANSEN HAINES, Manager of the Des Moines (Ia.) Gas Company, has informed the local authorities that the Company, instead of offering any objection to the proposed appointing of an officer to examine and report, at stated intervals, on the quantity and purity of gas sold in that city, he will gladly welcome such an appointee. All he asks is that a competent man be named.

AT a meeting of the Directors of the Marlboro (Mass.) Electric Company held some days ago, it was decided to call a shareholders' meeting the 13th inst., the object for discussion being whether or not the Company shall petition the Board of Gas and Electric Light Commissioners for authority to issue 1,300 shares of new stock, the proceeds to be used in retiring notes issued by the Company to pay for extensions and improvements.

WITH unfeigned sorrow we are obliged to chronicle the death of Mr. James P. Hamilton, the respected and beloved Treasurer of the Worcester (Mass.) Gas Light Company. His death (which was startlingly sudden) occurred the morning of the 1st inst., and the cause thereof was distension of the cardiac muscle. He was in his 69th year, having been born in Worcester, March 10, 1844. He is survived by Mrs. Hamilton and three children.

THE Ottawa (Canada) Gas and Electric Companies have applied to the authorities for the right to increase their respectiv e capitalizations—the former to $2,000,000, the latter to $3,000,000. Our informant adds that "The growth of municipal ownership in Canada, especially in the province of Ontario, is likely to make it increasingly difficult for corporations, operating under municipal franchises, to obtain legislation of this sort."

THE Public Service Commission, Second New York District, has authorized the Public Service Corporation, of Long Island, to execute and deliver a trust deed and mortgage to secure bonds of an aggregate amount not to exceed $5,000,000. The Company is authorized to issue forthwith bonds to the par of $304,000, to be sold at not less than 85, and common capital stock to the amount of $65,800, at not less than par. The proceeds are to be used for the construction of its main lines on Long Island, including not less than 70 miles, plus services; also, for meters and other paraphernalia for supplying gas to 2,100 consumers, 575 street lamps, and divers minor capital expenditures.

THE increase in business acquired by the Roanoke (Va.) Gas Company during 1912 shows an increase of 20 per cent. over that recorded in 1911. The Geist folks are evidently making good again.

ON the 31st ult. Receivers were asked for appointment by the Kansas-Missouri Gas Company, at the hands of Judge Van Walkenburg, of the Federal Court, on application of the Company's attorneys who declared that the selling rate established for the Kansas Natural Gas Company made it impossible for the distribnting Company to continue selling to consumers at the rate.

THE Coast Counties (Cal.) Gas and Electric Company has filed with the State Railroad Commission a petition for permission to purchase the Gilroy gas works at an upset figure of $25,000.

MR. JOHN MCWILLIAMS (President of the Board of Gas and Electrical Commissioners, Norwich, Conn.) is endeavoring to show or prove to his associates that $1 is about the proper rate to charge for gas in that busy spot. Better wait, Mr. Commissioner, until the price for enriching oil (or any sort of oil for that matter) will be made prior to next March, say.

ADVICES from Albany, N. Y., are to the effect that the Glens Falls (N. Y.) Gas and Electric Light Company will build a new retort house up to a production of 120,000 cubic feet per diem. It is also arranging for a delivery spur to run from the tracks of the Delaware and Hudson Railroad Company, into the works' yard.

ON January 1st the selling rate of the Georgetown (D. C.) Gas Company was increased from 85 cents to $1 per 1,000 cubic feet. And it is not at all impossible that Mr. Leiter's Company (the Washington gas corporation) will follow suit. Respecting this possibility the Washington *Times*, for the 22d ult., in an editoral on the matter of the Georgetown increase, among other things, said: "* * * There may be justification for the Georgetown Company's course. As matters stand, however, the public has no way to know, save to take the Company's word. This is not a proper condition of affairs. The public is entitled to know why such a move is made; to have the exact facts before it. A public utilities commission should pass on a proper application of the Georgetown Company for authority to raise its rate. If examination proved the reasonableness of the request, it would be granted. The public has no disposition to confiscate corporate property; but it has no desire to let the necessities of a small Company become the pretext on which the big Washington concern may base an effort to raise rates."

Publications.

[All Publications, Catalogues, etc., mentioned below, are kept in our office for the convenience of our patrons.]

"*Sanitary Control.*"—The Second Annual Report of the Joint Board of Sanitary Control in the cloak, suit and skirt industry, of New York City, reviews the work of the past 2 years, and includes a copy of the sanitary standards. Copies can be obtained by writing to the Board, at 31 Union Square, New York City.

"*Luxometer.*"—Pamphlet describing a new type portable "Illumination Photometer."

"*Efficiency Society.*"—The December number of the "Efficiency Society Bulletin" contains a list of new books on efficiency, and a bibliography out of periodicals from July 1, 1911, to June 30, 1912.

(*Continued from page 7.*)

that the stop-end retort, so constructed as to make it impossible to fill them full, is conceived on entirely wrong principles, and while better results can doubtless be secured, there will always be a large discrepancy and a large money loss in their operation.

Last year before the Institute we were presented with figures on the Providence Dessau verticals. While these data are not complete enough, they are of sufficient amount to be able to make a primary weight balance which is interesting. I will take for the balance the results given in July, 1911, as representing the highest gas yield.

Two Thousand Pounds of Coal.

Coke	1,400	pounds
Gas (assumed, specific gravity not given) 0.42 × 76.58 × 10,640	342	pounds
Tar 11 ×112 × .83	102	pounds
Assumed same as Worcester.—Moisture, less vapor; plus water of formation	139	pounds
NH_3 and S	20	pounds
Total	2,003	

This in turn shows an accounting for all the material charged and its accuracy is within the limits, considering that so many assumptions have to be made, but the fact remains that in this case, as at Manchester, there was a considerable amount of hydrocarbon in the original coal which are found in the coke as carbon. From the fact that the coke is given as exactly 70 per cent. in all the tests shown, I am led to believe that it was not determined in each instance. I think that if it were, and were accurate, careful gas analyses made of average samples, much useful information would be disclosed in making a thorough weight balance.

I believe that I have said enough to show the value of a weight balance. I believe the weight balance can be made a useful adjunct to all test-outs of new plants and should advise that one be made in this connection. The coke produced from a given amount of coal should be weighed from time to time, hot, and an analysis made of coal and coke; tar samples should be collected, with the quantity determinations, and last but not least, careful gas samples representing average productions should be secured. The water can be easily calculated or measured. The whole data can be digested into a balance by weight that will go a long way in explaining causes of success or failure.

The weight balance can also be made use of in sizing up guarantees of results to be produced, made by active selling agents. I have had opportunity on several occasions to show that such guarantees, apparently made in good faith, totalled up in weight to 100 pounds per short ton more than was put in.

On all plants also the balance can be well made use of to disclose failures and their cause, and perhaps remedies.

The weight balance on a coal gas setting can be carried into another field, the importance of which can scarcely be over estimated and is almost universally under estimated, namely the amount of fuel used to effect the carbonization of the coal. The chief cause of the lack of interest in this important factor of uneconomical operation, is the difficulty of tracing the efficiency of the fuel and the amount used in any practical way. Generally speaking, all bench fuel results are secured by difference, and, therefore, bear the omissions and commissions of all other features of coal and coke handling. It is worth careful analysis, however, and when it is realized that there are plants operating with 250 pounds of fuel and others on 350 pounds per ton of coal carbonized, and that this poor engineering, or poor operation, is subjecting the plant to an additional cost equal to the entire retort house labor cost and sufficient to pay the interest on an additional outlay of many dollars per ton of coal carbonized, then the use of the weight balance as a source of information may be considered important. Euchene gives the distribution of the heat from the bench fuel as follows:

Balance by weight (after Euchene) on bench of 8's, stop and horizontal bench, of bench fuel. Conditions as follows:

Make per mouthpiece	9,710
Yield per pound	4.91
Candle power, flat flame	13.50
Waste gases	1,112° F.
CO_2	18.40

Furnace fuel 296 pounds per 2,000 pounds carbonized.

Distribution of coke energy, by pounds of furnace fuel:

	Pounds per Ton.
By sensible heat of flue gases	96.4
By sensible heat of gaseous vapors	52.8
Sensible heat of coke	70.8
By radiation	79.2
By formation of volatile compounds	5.7
By decomposition of coal	74.6
By sensible heat of clinker	3.1
Total	383.0
By credit due to heat of formation of volatile compounds	87.0
	296.0

This 296 pounds per short ton represents no better than average practice, and not nearly so good as many plants are able to effect by changes in design and methods of operation. Let us consider in what points of this balance economies and wastes may occur. Eliminate at once the following:

	Pounds per Ton.
Sensible heat of flue gases	96.4
" " " gaseous vapors	52.8
" " " coke	70.8
Formation of volatile compounds	5.7
Decomposition of coal	74.6
Sensible heat of clinker	3.1
Total	303.4
Less credit of	87.0
Necessary for carbonization under conditions stipulated, without radiation	216.4

The radiation loss of 79.2 pounds is, of course, largely necessary, but can undoubtedly be improved upon, and is accomplished in some plants. The fact is, therefore, patent that no lower bench fuel per ton of coal carbonized can be effected unless, first, the sensible heat of the escaping flue gases is lowered and recovered, below the 1,112° named here. This may be accomplished by more effective recuperation. It may also be affected somewhat by a lowering of the quantity and specific heat of the escaping flue gases. For example, by the use of CO_2 instead of steam as an endothermic, the quantity of gases for the same CO_2 content will be exactly the same, except that there will be an additional heat carrier of .4 pound of steam per pound of combustible. This would subtract from the furnace fuel—*i.e.*, CO_2 endothermic in place of steam—10.5 pounds carbon, or about 13 pounds of coke per ton of coal carbonized. The heat losses by gaseous vapors is a necessary loss, varying some little with various systems of operation. The sensible heat of coke (net coke) cannot be recovered, except in such systems as cool the coke by the use of the secondary air by special design. This gives more heat to be utilized in the spent gases, which might, on the other hand, be easily recovered as useful energy in the form of steam.

The three items—"by formation of volatile compounds," "decomposition of coal," and "sensible heat of clinker"—need no comment, as they are unavoidable losses.

The question arises then, in what are the losses in many plants over and above these figures? The answer must be in either escaping latent heat at the stack, or unconsumed carbon in the ash. The last named is very easily ascertained by careful examination into quantity and quality of the material withdrawn from under the fire. It may be noted in passing that this is a frequent source of large losses.

In regard to the losses at the stack. This is not so easy a problem, for its must be borne in mind that casual sampling of flue gases is apt to be very misleading, inasmuch as natural draft is dependent on fire conditions, and that in plants with small grate area and low fusing ash coals, the quantity of primary air varies largely between cleanings and slicing of fires.

This loss of 96.4 pounds of coke per ton at the stack involves a composition of the gases of 18.4 per cent. CO_2. Each per cent. of CO at the stack represents an unnecessary loss of 12 pounds of fuel per ton carbonized. Each per cent. O_2 in the flue gases represents an increase in volume of 5 per cent., and roughly at the 1,112° F. means a loss of 3.5 pounds of coke. The chief source of loss in bench fuel, and as I have said before this is a loss unappreciated in most plants, would seem to be due to losses at the stack through insufficient or excess secondary air. That this loss may be due to both in the same bench, at different periods of the clinkering cycle, is not improbable. Its remedy lies in better design of furnaces and grates.

Another weight balance which can be made a practical balance is on ammonia. There are two forms of ammonia to be checked, fixed ammonia and gaseous ammonia. It is with the latter that I wish to

deal chiefly in a brief manner. The gas issuing from the hydraulic main can be readily sampled and tested for ammonia content with the hydrogen sulphide burette. By the use of a solution of sulphuric acid of standard strength the grains of ammonia per 100 cubic feet can be readily ascertained. By measuring the fixed ammonia from the quantity and quality of the liquor coming from the hydraulic main, and adding to this the amount of ammonia in the gas per ton of coal carbonized, the ammonia *made* per ton can be readily ascertained. Comparing this with the amount recovered for sale will give a comparison, of profit and interest.

The appendix to this paper carries a number of charts showing the distillation and dephlegmation of tars secured from home and abroad from nearly all the present systems. While you may wonder what this has to do directly with my subject of weight balance, nevertheless I present them as bearing somewhat on the points in regard to fixed carbon that I have made in a comparison of weight balances at Worcester and Manchester.

By examination you will see that the tar from all plants, where the gas passes through coal or coke on the way to the take-off, the fixed carbon is low. In the horizontal tars at Worcester, and the inclined and horizontal tars, at Astoria, N. Y., the carbon is high. To prove that the low carbon in vertical gas travel designs is due to what might be called filtering out of the carbon, I wish to draw your attention to the tar at Joliet, Ills., from the Koppers' coke ovens at the United States Steel Corporation's plant. The heats at this plant are unusually high, due to a very low coking time. The tar yield at this plant is exceedingly low as regarded by our standard; the coke yield very high; the tar contains, as shown, but 8.02 per cent. free carbon. At Manchester, N. H., the top of the retort is left unfilled, the carbon is 8.12 per cent.; at Providence, R. I., with filled retorts, 4.1 per cent.

The discussion of these charts would make a paper by itself, so I must not get into it any deeper. My chief desire in presenting them here was to bring the information before the Institute.

APPENDIX.

St. Helens, England. Foul Main. Continuous Verticals.

Specific gravity 1.086
Unsulphonated mat ..... 8.6 per cent.
Free carbon ..... 3.3 per cent.

Straight Distillation.

Temperature, Degs. F.	Per Cent. by Volume.	Per Cent. by Weight.	Specific Gravity.
Up to 300	0.5	1.31	0.9437
300 to 350	1.0		
350 to 400	5.6	5.00	0.9635
400 to 450	14.1	12.90	0.9857
450 to 500	12.0	11.14	1.001
500 to 550	5.5	5.19	1.018
550 to 600	13.8	13.36	1.0432
600 to 650	5.2	5.11	1.060
650 to 700	14.0	13.98	1.0796
700 to 750	2.2	2.28	1.1182
Above 750	8.8	9.69	1.188
Coke	..	17.07	....
	82.7	97.03	

Once Dephlegmated.

Temperature Degs. C.			
Up to 100	1.5	3.29	0.8941
100 to 135	0.5		
135 to 170	2.0		
170 to 200	8.5	8.07	1.0313
Res. above 200	86.9	88.00	1.105
	99.4	99.36	

St. Helens, England. Condensers. Continuous Verticals.

Specific gravity 1.079
Unsulphonated mat ..... 12.5 per cent.
Free carbon ..... 3.4 per cent.

Straight Distillation.

Temperature, Degs. F.	Per Cent. by Volume	Per Cent. by Weight.	Specific Gravity.
Up to 250	2.5	3.44	0.9199
250 to 300	1.5		
300 to 350	4.5	3.89	0.9246
350 to 400	9.7	8.75	0.9633
400 to 450	13.5	12.56	0.9931
450 to 500	11.5	11.02	1.022
500 to 550	11.5	11.37	1.055
550 to 600	20.0	20.52	1.0945
600 to 650	8.0	8.92	1.189
Coke	...	18.65	....
	82.7	99.12	

Once Dephlegmated.

Temperature. Degs. C.			
Up to 100	3.7	3.48	0.8540
100 to 135	0.7		
135 to 170	4.0	3.35	0.9055
170 to 200	9.0	8.07	0.9675
Res. above 200	82.0	84.7	1.1345
	99.4	99.6	

Sunderland, England. Dessau Verticals.

Specific gravity 1.123
Unsulphonated mat ..... 10.1 per cent.
Free carbon ..... 3.2 per cent.

Straight Distillation.

Temperature, Degs. F.	Per Cent. by Volume.	Per Cent. by Weight.	Specific Gravity.
Up to 300	2.0	2.7	0.9327
300 to 350	1.3		
350 to 400	7.0	6.02	0.9785
400 to 450	11.0	9.74	1.008
450 to 500	7.0	6.34	1.030
500 to 550	6 8	6.27	1.050
550 to 600	8.1	7.69	1.0805
600 to 650	13.3	13.0	1.1127
Above 650	22.0	22.3	1.1560
Coke	..	22.7	....
	78.5	96.76	

Once Dephlegmated.

Temperature, Degs. C.			
Up to 100	4.0	3.54	0.8821
100 to 135	0.5		
135 to 170	1.5	1.25	0.9372
170 to 200	7.2	6.35	0.9896
Res. above 200	85.0	87.00	1.1254
	98.2	98.14	

Frankenthal, Germany. Klönne Chamber Ovens.

Specific gravity 1.122
Unsulphonated mat .... 6.1 per cent.
Free carbon ..... 5.4 per cent.

Straight Distillation.

Temperature, Degs. F.	Per Cent. by Volume.	Per Cent. by Weight.	Specific Gravity
Up to 300	2.0	4.82	0.9043
300 to 350	4.0		
350 to 400	5.5	4.74	0.9709
400 to 450	13.5	12.21	1.018
450 to 500	10.0	9.10	1.025
500 to 550	3.8	3.56	1.055
550 to 600	6.0	5.75	1.079
600 to 650	9.3	9.13	1.1043
650 to 700	9.4	9.56	1.1345
700 to 750	9.2	9.52	1.165
Above 750	3.1	3.37	1.225
Coke	..	24.60	....
	75.8	96.36	

Once Dephlegmated.

Temperature, Degs. C.			
Up to 100	2.6	3.07	0.8685
100 to 135	1.5		
135 to 170	2.3	1.79	0.9062
170 to 200	8.5	7.3	0.9951
Res. above 200	84.8	87.38	1.159
	99.7	99.54	

Innesbruck, Austria. Koppers Chamber Ovens.

Specific gravity 1.073
Unsulphonated mat ..... 5.5 per cent.
Free carbon ..... 1.9 per cent.

Straight Distillation.

Temperature, Degs. F.	Per Cent. by Volume.	Per Cent. by Weight.	Specific Gravity.
Up to 350	19.5	16.98	0.9475
350 to 400	1.3	10.39	0.9580
400 to 450	10.5		
450 to 500	9.9	9.16	1.0078
500 to 550	4.3	4.05	1.027
550 to 600	12.2	11.80	1.052
600 to 650	7.2	7.08	1.0707
650 to 700	9.5	9.60	1.1004
Above 700	1.00	11.16	1.214
Coke	..	17.40	....
	84.4	97.62	

Once Dephlegmated.

Temperature, Degs. C.			
Up to 100	3.75	3.0	0.8590
100 to 135	2.25	1.9	0.9069
135 to 170	2.0	1.73	0.9279
170 to 200	9.5	8.63	0.9747
Res. above 200	80.4	82.74	1.115
	97.90	98.0	

MANCHESTER, N. H., U. G. I. VERTICALS.

Specific gravity 1.1245
Unsulphonated paraffine mat ..... 6.5 per cent.
Free carbon ..... 8.12 per cent.

Straight Distillation.

Temperature, Degs. F.	Per Cent. by Volume.	Per Cent. by Weight.	Specific Gravity.
Up to 300	0.5	0.41	0.9290
300 to 350	1.4	1.13	
350 to 400	6.8	5.75	0.9665
400 to 450	12.3	10.90	1.0065
450 to 500	8.2	7.47	1.0342
500 to 550	5.4	5.0	1.05
550 to 600	9.1	9.07	1.087
600 to 650	5.4	5.27	1.0956
650 to 700	12.7	22.74	1.1294
700 to 750	5.4	5.65	1.17
Coke	..	35.5	....
	67.2	98.89	

Once Dephlegmated.

Temperature, Degs. C.			
Up to 100	0.0	0.0	....
100 to 135	0.4	1.4	0.8701
135 to 170	1.4		
170 to 200	4.7	4.1	0.9708
Residue	90.0	93.3	1.1660
	96.5	98.8	

WORCESTER, MASS. THRU' HORIZONTALS.

Specific gravity 1.284
Unsulphonated mat ..... 2.1 per cent.
Free carbon ..... 35.8 per cent.

Straight Distillation.

Temperature, Degs. F.	Per Cent. by Volume.	Per Cent. by Weight.	Specific Gravity.
Up to 400	1.0	3.72	1.063
400 to 450	3.5		
450 to 500	3.5	2.91	1.071
500 to 550	3.3	2.77	1.078
550 to 600	4.0	3.4	1.085
600 to 650	11.0	9.4	1.096
Above 650	9.0	8.0	11.24
Coke	..	64.70	
	35.3	94.9	

Once Dephlegmated.

Temperature, Degs. C.			
Up to 100	0.0	....	....
100 to 135	0.0	....	....
135 to 170	0.5	1.23	1.059
170 to 200	1.0		
Res. above	98.2	98.6	1.291
	99.7	99.83	

JOLIET, ILL.—KOPPERS COKE OVENS.

Specific gravity 1.155
Unsulphonated mat. ..... 4.3 per cent.
Free carbon ..... 8.02 per cent.

Straight Distillation.

Temperature Degs. F.	Per Cent. by Vol.	Per Cent. by W.	Spec. Grav.
Up to 450	9.0	8.1	1.041
450 to 500	10.0	9.4	1.080
500 to 550	3.4	3.2	1.098
550 to 600	4.8	4.6	1.102
600 to 650	9.0	8.7	1.120
650 to 700	10.2	10.5	1.187
700 to 750	9.5	9.8	1.192
Above 750	10.2	10.5	1.200
Coke	—	33.5	—
	66.1	98.3	

Once Dephlegmated.

Temperature, Degs. C.			
Up to 100	0.0	—	..
100 to 135	0.0	—	..
135 to 170	1.03	0.9	1.029
170 to 200	1.03	0.9	1.029
Res. above 200	98.7	99.1	1.161
	99.73	100.0	

INDIANAPOLIS, IND.—COKE OVEN PLANT.

Specific gravity at 60° F. 1.160
Unsulphonated mat. ..... 1.0 per cent.
Free carbon ..... 6.8 per cent.

Otto-Hoffman Ovens.

Straight Distillation.

Temperature Degs. F.	Per cent. by Vol.	Per cent. by Wt.	Spec. Grav.
Up to 350	0.2	2.7	0.9743
350 to 400	3.0		
400 to 450	11.0	9.65	1.014
450 to 500	8.4	7.45	1.028
500 to 550	7.1	6.42	1.047
550 to 600	4.5	4.15	1.070
600 to 650	9.0	8.65	1.111
650 to 700	10.5	10.05	1.104
Above 700	12.0	11.80	1.139
Coke	—	31.95	..
	65.7	92.82	

Once Dephlegmated.

Temperature, Degs. C.			
Up to 100	None	..	..
Up to 135	0.2	..	..
135 to 170	0.9	0.86	0.9093
170 to 200	5.3	4.56	0.9985
Above 200	93.3	94.45	1.173
	99.7	99.87	

PROVIDENCE, R. I.—VERTICAL RETORTS.—SASSAFRAS POINT STATION —DESSAU VERTICALS.

Specific gravity at 60° F. 1.1387
Unsulphonated mat. ..... 1.0 per cent.
Free carbon ..... 4.10 per cent.

Straight Distillation.

Temporature Degs. F.	Per cent. by Vol.	Per cent. by Wt.	Spec. Grav.
Up to 350	3.5	2.89	0.9370
Up to 350	3.5	2.89	0.9370
350 to 400	4.0	3.44	0.9769
400 to 450	10.0	08.82	1.0073
450 to 500	12.4	11.20	1.0280
500 to 550	4.5	5.15	1.0487
550 to 600	6.5	6.12	1.0688
500 to 650	7.0	7.10	1.1550
650 to 700	11.0	11.36	1.1741
700 to 750	12.5	13.26	1.2070
Above 750	2.2	2.52	1.2424
Coke	—	27.45	
	73.7	99.31	

Once Dehplegmated.

Temperature, Degs C.			
Up to 100	0.5	1.58	0.9023
100 to 135	1.5		
135 to 170	1.2	1.03	0.6944
170 to 200	3.6	3.14	0.9932
Residue	93.2	95.02	1.1709
	100.0	100.77	

FITCHBUGH, MASS.—CONTINUOUS VERTICAL RETORTS.—GLOVER-WEST PROCESS.

Specific gravity at 60° F. 1.1067
Unsulphonated mat. ..... 0.15 per cent.
Free carbon ..... 1.15 per cent.

Straight Distillation.

Temperature Degs. F.	Per Cent. by Vol.	Per Cent. by Wt.	Spec. Grav.
Up to 300	1.7	6.35	0.9237
300 to 350	2.0		
350 to 400	3.9	9.40	0.9833
400 to 450	10.6		
450 to 500	1.130	11.68	0.9937
500 to 550	8.0	7.50	1.0051
550 to 600	7.3	6.77	1.0286
600 to 650	7.5	7.14	1.0566
650 to 700	1s.0	12.66	1.0981
Above 700	17.4	18.70	1.1902
Coke		19.79	
	84.4	99.99	

Once Dephlegmated.

Temperature, Degs. C.			
Up to 100	0.5	1.18	0.8619
100 to 135	1.0		
135 to 170	2.8	2.23	0.8912
170 to 200	7.5	6.58	0.9720
Above 200	88.2	80.00	1.1308
	100.0	99.99	

ASTORIA, L. I.—INCLINED RERORT TAR.

Specific gravity at 60° F..... 1.2146
Unsulphonated matter..... 2.0 per cent.
Free carbon by weight.....21.77 per cent.

Straight Distillation.

Temperature, Degs. F.	Per Cent. by Vol.	Per Cent. by Wt.	Spec. Grav.
Up to 350	1.2	5.90	0.9798
350 to 400	6.0		
400 to 450	10.0	8.73	1.0463
450 to 500	8.2	7.25	1.0554
500 to 550	6.2	7.26	1.0645
550 to 600	4.5	4.07	1.0945
600 to 650	7.0	6.53	1.1238
650 to 700	9.0	8.73	1.1521
Above 700	6.5	6.70	1.2299
Coke	....	45.50	....
	58.7	99.18	

Once Dephlegmated.

Temperature, Degs. C.			
Up to 100	1.2	2.02	0.9012
100 to 135	1.5		
135 to 170	1.8	1.40	0.9413
170 to 200	5.3	4.38	1.0054
200 to 225	11.8	10.32	1.0636
Residue	78.4	81.80	1.2652
	100.0	99.92	

ASTORIA, L. I.—HORIZONTAL RETORT TAR.

Specific gravity at 60° F..... 1.2478
Unsulphonated matter..... 0.8 per cent.
Free carbon by weight.....29.56 per cent.

Straight Distillation.

Temperature, Degs. F.	Per Cent. by Vol.	Per Cent. by Wt.	Spec. Grav.
Up to 350	1.0	3.33	0.9819
350 to 400	3.2		
400 to 450	9.2	7.72	1.0442
450 to 500	7.6	6.53	1.0659
500 to 550	4.0	3.47	1.0791
550 to 600	6.5	5.70	1.0925
600 to 650	6.6	6.02	1.1341
650 to 700	11.0	9.65	1.1793
700 to 750	6.0	5.86	1.2179
Above 750	6.0	5.96	1.2400
Coke	....	44.89	....
	61.1	99.13	

Once Dephlegmated.

Temperature, Degs. C.			
Up to 100	1.0	0.86	0.9174
100 to 135	1.8	1.94	0.9662
135 to 170	0.6		
170 to 200	2.5	2.04	0.9999
200 to 225	11.5	9.63	1.0223
Residue	82.6	83.72	1.2531
	100.0	98.19	

LUTON, ENGLAND.—CONTINUOUS VERTICAL TAR. WOODALL-DUCKHAM PROCESS.

Specific gravity at 60° F..... 1.1080
Unsulphonated matter..... None
Free carbon by weight..... 7.45 per cent.

Straight Distillation.

Temperature, Degs. F.	Per Cent. by Vol.	Per Cent. by Wt.	Spec. Grav.
Up to 350	1.0	5.28	0.9399
350 to 400	5.1		
400 to 450	11.7	10.52	0.9774
450 to 500	11.0	9.98	1.0072
500 to 550	6.5	6.05	1.0206
550 to 600	8.0	7.64	1.0398
600 to 650	13.5	13.05	1.0637
650 to 700	13.0	12.85	1.0933
Above 700	10.0	11.02	1.2128
Coke	....	23.11	....
	79.8	99.50	

Once Dephlegmated.

Temperature, Degs. C.			
Up to 100	0.9	1.80	0.8645
100 to 135	0.5		
135 to 170	1.0		
170 to 200	9.2	7.52	0.9629
200 to 225	14.8	12.82	1.0010
Residue	73.6	77.83	1.1809
	100.0	99.97	

LEOPOLD, VIENNA, AUSTRIA.—TAR FROM KOPPERS CHAMBER OVENS.

Specific gravity at 60° F..... 1.1068
Unsulphonated matter..... 5.0 per cent.
Free carbon by weight..... 2.65 per cent.

Straight Distillation.

Temperature, Degs. F.	Per Cent. by Vol.	Per Cent. by Wt.	Spec. Grav.
Up to 300	2.9	5.67	0.8977
300 to 350	4.1		
350 to 400	11.2	9.73	0.9620
400 to 450	10.5	9.51	1.0024
450 to 500	7.8	7.28	1.0332
500 to 550	7.2	6.93	1.0660
550 to 600	8.3	8.08	1.0774
600 to 650	7.3	7.22	1.0951
650 to 700	8.0	8.10	1.1213
700 to 750	13.0	13.40	1.1414
Above 750	7.2	7.97	1.2260
Coke	....	16.10	
	87.5	99.99	

Once Dephlegmated.

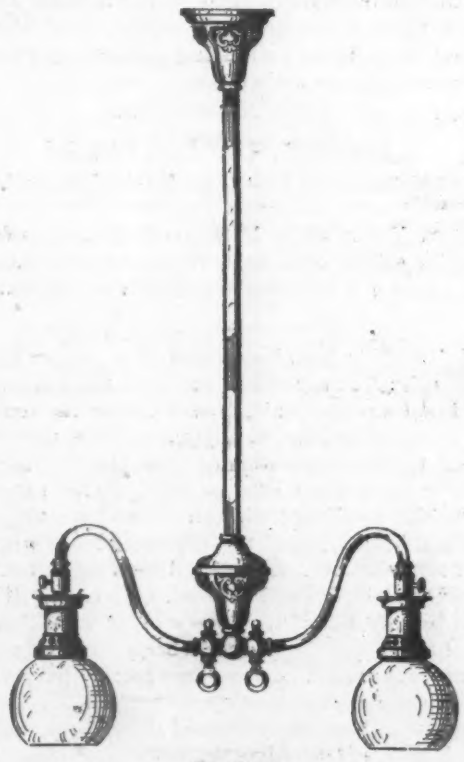
Temperature, Degs. C.			
Up to 100	0.6	3.50	0.8500
100 to 135	3.9		
135 to 170	2.0	1.68	0.9297
170 to 200	8.1	7.16	0.9766
Residue	85.4	87.85	1.1374
	100.0	100.19	

New Methods and Appliances.

SMALL INVERTED LAMP GAS FIXTURES.—There has been much talk and also writing the past few years on illumination, and there is no question but that much good has been accomplished thereby.

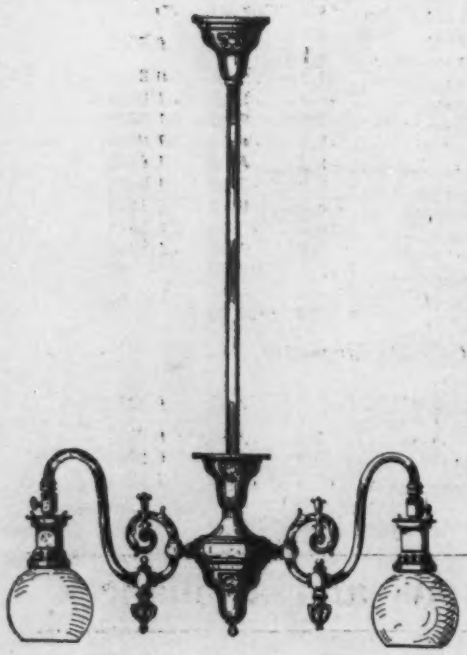
The continued evolution of the gas lighting industry and its accessories, makes it necessary to keep on writing in order that all be kept posted on that which is being done by the manufacturers to better serve the dealer and keep the public near to content. These form a great combination worthy of encouragement by everyone connected with the trade.

In view of this thought we herewith illustrate a sample or two of new gas fixtures for our readers, for we believe they have merit in appearance and efficiency.



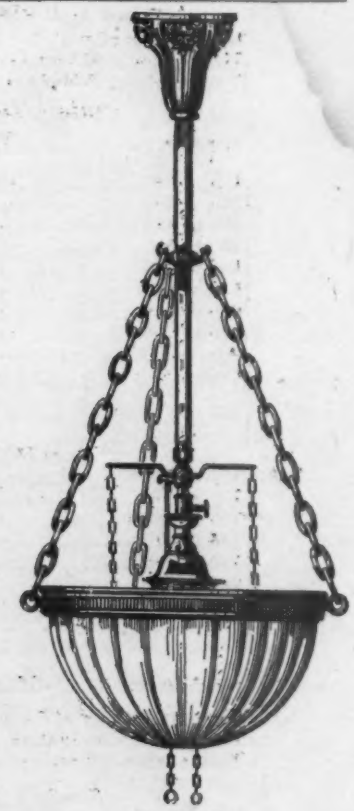
No 1837-G.

With the burners here shown these fixtures all can be lighted without any greater cost than the one single, large reflex burner, at the same time giving a much better effect in the room. They lend to the fixture much better appearance than the single, large burner;



No. 1640-G.

No. 23 3-G.



No. 2366-G.

Further they are superior in style, and the light is bettor distributed in the room.

The fixture being evenly balanced, it is much better to look upon all these burners lighted on a chandelier than to see one lighted, while the others are dark.

There are, of course, many other styles of gas fixtures, some using the chain effect, the semi-Indirect and the Art Glass, too. But it certainly is a good plan to show these many types, all lighted, in order to create a desire in the consumer to have them in his home.

The average man does not go hunting for an opportunity to spend his money to improve his condition in the lighting line, for many of them look upon it as a necessary evil, or that they have to use such. So they must be shown the new methods and comforts in order to get them to change their ideas.

Items of Interest
FROM VARIOUS LOCALITIES.

MR. WALTER WOOD, of R. D. Wood & Co., whose kindly, well placed charities, seldom come to light, has donated $1,000 cash to the fund under which it is proposed to maintain an hospital in Millville, N. J.

"B. M. M.," writing from Eau Claire, Wis., under date of the 26th ult., incloses this: "For years it has been the custom of the Eau Claire Gas Light Company to gather together its men of high and low degree on Christmas eve, to enjoy a reunion, the effect of which is heightened by the distribution of gifts, the uttering of speeches bearing hearty expressions of goodwill, and the extending of the hand of friendship to all and with all. This year, the usual gathering was called, but it lacked the presence of one who, to us all is more parent than director, more friend than employer. The absent one was Mr. David Douglas, President, who is still ill at his home, though most happily recovering from a battle with disease that only the strong-of-heart and the active-of-brain may turn into victory. However, his boys did not in any sense forget that their employer, their sponsor, their friend, was not with them, for the morning of that day they (30 of them) had expressed to him by special messenger, a beautiful loving cup in silver, suitably inscribed. The remembrance was accompanied by an autograph letter, asking his acceptance of their offering in words, the very nature of which showed they were indicative of the thoughts that bound him to them. Even at the risk of the blue pencil, I venture to repeat the opening paragraph of the message. It was thus worded: 'The employees of the Eau Claire Gas Light Company wish this day to extend to you a Merry Christmas and a Happy New Year. It is with the deepest regret to all of us that the old, familiar face we love so well is not present with us this year, and from your speech not to hear the heart-to-heart talk that on Christmas eve we have heard in the years gone by. All the employees look forward each year to this gathering. The kind advice given and the warm words of friendship spoken on these occasions by you have always brought about a closer relationship between us.' * * *.' The balance of the message was equally fraternal, but this above excerpt will suffice. Naturally, the men having thus unburdened themselves to their Chief, were in all the kindlier mood to share in the final chapters of the session that brought them together. The next man to feel the weight of remembrance was that prince of chaps, Mr. 'Chris.' Luebkeman, the all-pervading Secretary and Treasurer of the corporation. 'Chris.' had no more idea than a 'Martian brother,' that anything material was about to befall him; but he knows better now. 'Al. Smith' was the one who caused Mr. L.'s astonishment. Acting as spokesman 'Al.' stepped forth from the ranks, and, in rather uncertain tones at first, told 'Chris.' what the Company's men thought of him, and wound up by presenting the Secy.-Treas. with a beauty in the shape of a heavy silver service tray. 'If 'Al.' stumbled a bit in the presentation speech the receiver was even in worse plight. However, he got himself together after a brief struggle, and by the time he had virtually narrated the history of the Company's early struggles, he got right to his own genial self, and his words of appreciation of the steadfastness of the Company'y men bore the stout ring of the Luebkeman belief in both. Then came the turkey sharing act. The thirty faithful ones were given the option of bringing home a turkey, not one of which royal birds weighed less than 18 pounds, or of accepting a monetary remembrance. Then came another voiceful expression of good wishes and good will, and the 'party' was at an end."

MR. J. H. ENRIGHT will, for many an evening, enjoy to the full, his "den" at home, in that now and hereafter it will be graced by the setting of a handsome smoking set—a smokers' table, chair and foot rest—presented to him by the employees of the Frederick (Md.) Gas and Electric Company the morning of last Christmas.

"D. R. T.," writing from Port Jervis, N. Y., under date of the 28th ult., informs us that Mr. Herbert Senger, who for the past 5 years has been connected with the Port Jervis Light and Power Company, as Engineer of its gas department, and as Assistant General Manager of the Company, will hereafter be associated with the Consolidated Gas Purification and Chemical Company, with headquarters in New York city.

THE proprietors of the Benton Harbor and St. Joseph (Mich.) Gas Company have decided to construct a modern coal gas plant, at an estimated expenditure of $50,000.

ANOTHER point in Indiana, which will build a coal gas plant early in 1913, is that for which the Linton Gas Company was chartered. The scheme, as at present thought out by Manager Russell, contemplates a plant and high pressure system, the completing of which will incur an expenditure of $300,000. Under the agreement the main system will likely mean the placing of 28 miles of mains, which will hook up the settlements of Sullivan, Jasonville, Atlas, Onneger, Cass, Vicksburg and Midland.

MISS A. W. LINDSAY has resigned the position of Cashier in the Visalia offices of the Central California Gas Company. Her successor is Mr. Charles R. King, of Los Angeles, who was formerly connected with the Southern California Edison Company.

"DEAR JOURNAL: Well, perhaps the 'bunch' who work for the Fulton County Gas and Electric Company, of Gloversville, N. Y., did not have a jolly time one evening in Christmas week. The 'annual Christmas tree feast' was about the jolliest thing ever brought off in this section. We had a feast, after which the 'tree' was turned in and turned over; and, to make the occasion complete, a real, live Santa Claus was on the scene—only he carried his pack on a sleigh so huge that he couldn't arrive via the chimney-way. So he stopped at the front door—you bet 'twas opened for him—and the thoughtful old buck had a present for everyone. After the feast we listened to a lot of speeches, the cleverest of which was likely that by Manager Hodgson; although 'Bill.' Edwards was a good second. I had almost forgotten to say that lineman O'Connor was the lucky one in getting the number that enabled him to carry home a huge box that held a chicken dinner big enough for a family four times the number that 'Bill' will ever have; and he hasn't been idle along such lines either. The affair was simply 'great.'"

THE work of construction on the plant of the Corpus Christi (Tex.) Gas Company is underway. It will be built under the direct supervision of Mr. Herbert L. St. John, General Superintendent for the Wallace syndicate, of Detroit, Mich., who are the owners of the franchise. These go-ahead builders, are also the builders and owners of the gas plants in the thriving Texas settlements of Waxahachie and Temple. They say that this Corpus Christi venture will be completed by April 1st.

IN this connection we may note that a second franchise for a gas plant in Corpus Christi was voted (by ballot) the Bruce syndicate in a special election held there the 21st ult. It is true that only a small proportion of the actual voting strength of this unreasonably named place was cast (a total of 322), but the "ayes" had it in big measure —220 to 102. The Bruce syndicate is we believe of Philadelphia existence.

THE City Council, of Paxton, Ills., has extended for a twelvemonth the time during which the ordinance granted to A. E. Dunn and O. L. Lewis, had to live 1 year—from December 5, 1911—was issued.

THE Public Service Commission, of Oregon, has decided that the action of the Seattle Lighting Company, in advancing the readiness-to-serve charge to a minimum bill of 50 cents per month, instead of 25 cents per month, is warranted, from a thorough review of the facts in the case as presented by the city and by the Company.

MR. O. E. OSTHOFF, Vice-President and Chief Engineer of Messrs. H. M. Byllesby & Co., announces the appointment of Mr. W. P. Thompson, formerly Assistant Chief Engineer of the Corporation, as Manager of Engineering and Construction for the Byllesby concern. The appointment became effective the 1st inst.

THE New Hampshire Public Commission has authorized the Keene Gas and Electric and the Ashuelot Gas and Electric Companies to furnish electric currents to the residents of the town of Westmoreland.

As a token of their recognition of his valuable services in the management of the Gardiner (Me.) Gas, Fuel and Light Company, the proprietors some days ago presented to Mr. A. A. Laughton a silver loving cup.

MR. C. S. MORGAN, formerly Manager of the new business division of the Plattsburg (N. Y.) Gas and Electric Company, has been appointed General Manager of the city of Lincoln (Ills.) Gas Company, succeeding Mr. H. S. Bramwell, resigned. This change comes about through ownership of the Company having been acquired by other interests.

"W. P.," writing from Sag Harbor, Long Island, the last week in December, says: "The project for supplying gas to 'The Hamptons,' those natural beauty spots on the southeast shore of Long Island, will not down, and it now looks that, upon the completion of the large gasholder in process of erection for the Sag Harbor Lighting Company, the latter will extend its main system to Easthampton and Southampton, the residents of which places are eagerly awaiting a gas supply. In fact last summer it was proposed to make this extension, at least to Southampton, but the Trustees of that village, rather unaccountably to some minds, having dilly-dallied, through adjournments, postponements, and general dilatory tactics, managed to have the matter tabled to the present time. To many, however, the reason for this delay is apparently in the fact that some of the Trustees are 'close' to the people who control the electric lighting system of The Hamptons. There is good reason; that is, good reason to them, but very indifferent reasoning, did they know what the real effect of a gas supply would be on their property. Fully five-sevenths of the gas used would be used on domestic account, other than illuminating, and to the expert who follows such things, there would be more electric current used were gas in the field, if both systems were under the one control, and were each division put on its metal to secure new business in the opponents territory. Nor would such growth be hampered at all by the fact that fair prices for both gas and electric currents were maintained. Indeed, there is no reason whatever that a combined gas and electric service should not prove a paying venture in the territory named, particularly from April 1st to October 30th.

THE cut gas rates in the entire territory served by the Western United Gas and Electric Company, which territory holds 30 or more thriving settlements, dropped to 90 cents per 1,000 cubic feet with the ringing in of the New Year.

THIS was the interesting programme prepared by the Omaha (Kas.) Gas Company for the entertainment of its employees the afternoon and evening of December 24th last. The entertainment was enjoyed in the Company's main, office No. 1503 Howard street. The affair was under the management of Mr. W. H. Taylor:

Introduction..... ....W. H. Tayor.
"Invictus"..... .... Huhn.
Harry S. Disbrow.
Accompanist..... Miss Beulah Mahon.
"Good Night"..... .....Nevins
Miss Beulah Mahon.
"Christ was a Little Baby"..... ——
Lillian Snow.
"Santa's Visit" ....Herbert Wood.
"Birthday of a King" ...Neidlinger.
Harry S. Disbrow.
Accompanist.. ....Miss Beulah Mahon.
"The Christmas Story."
Mr. G. W. Clabaugh.
Presentation of gold medal to Andrew Anderson, 1888-1913, by Mr. G. W. Clabaugh.
Entrance of Santa Claus. Distribution of Gifts,

"THE Board of Aldermen, of Burlington, N. C., have granted to a Philadelphia corporation a franchise under which the latter will construct and operate a gas plant in the named place. The plant will be located near the Fair Ground, East Burlington, and it is the determination of the proprietors to pipe over to the outlying settlements of Graham and Haw. A site has been purchased, and it is said that work on construction will be proceeded with at once. The named place is a busy, thriving settlement of Alamance county, N. C., and is located on the Southern Railroad, at a point 21 miles east of Greensboro. It is the center for several large cotton mills, has prospereus banking institutions, and is altogether a busy, growing place. Its population, which has doubled during the past 10 years, now numbeas not less than 8,000 people.

Recent Patent Issues.

Prepared for the AMERICAN GAS LIGHT JOURNAL by ROYAL E. BURNHAM, solicitor of patents and counselor in patent causes, 833 Bond Building, Washington, D. C., from whom illustrations and specifications of any patent mentioned below may be obtained for 20 cents.

1,048,016. Incandescent Gas Burner. O. Wiederhold, Jersey City, N.J.
1,048,177 Heating Device or Attachment for Gas Burners. P. W. Kohloff. Larchmont, N. Y., assignor of one half to J. Schaeffer, Mount Vernon, N. Y.
1,048,355. Heat Distributing Device for Gas Ranges. W. A. Schoenhaar, Wilmington, Del.
1,048,430. Machine for Use in the Manufacture of Incandescent Gas Mantles, J. I. Robin, London, England.

The Market for Gas Securities.

The change in values of city gas shares, as between the last week of 1912 and the latter part of the first week of 1913, is slight. Consolidated gas came in to-day (Friday) at 140 to 140¼, but inquiries were very light. The last dividend on New York Mutual (declared the 17th of last month) was at the rate of 4 per cent. for 6 months.

In out-of-town shares Brooklyn Union is a trifle higher, but the dealings in the stock are virtually nil. Peoples, of Chicago, is a trifle stronger, and Lacledes are at ridiculously low figures, every feature of the situation being considered. A review for the year shows that no other class or sort of securities show better advances in values than gas shares. This is especially so of the New England shares, the average advance in which (12 Companies outside the Boston district being considered) amounts to 19 per cent.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

115 BROADWAY, NEW YORK CITY.

JANUARY 6.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share:

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked*
Consolidated Gas Co.	$78,177,000	100	140	140¼
Central Union Gas Co.—				
1st 5's, due 1972, J. & J.	3,000,000	1,000	108	106
Equitable Gas Light Co.—				
Con. 5's, due 1932, M. & S.	1,000,000	1,000	105	106
Mutual Gas Co.	3,500,000	100	182	187
New Amsterdam Gas Co.—				
1st Con. 5's, due 1948, J. & J.	11,000,000	1,000	101	102½
New York & Richmond Gas Co. (Staten Island)	1,500,000	100	35	50
1st Mtg. Gold Bds. 5 p. ct.	1,500,000	—	98½	100½
New York and East River—				
1st 5's, due 1944, J. & J.	3,500,000	1,000	103	105
Con. 5's, due 1945, J. & J.	1,500,000	—	95	100
Northern Union—				
1st 5's, due 1927, J. & J.	1,250,000	1,000	99½	101
Standard	5,000,000	100	60	70
Preferred	5,000,000	100	90	100
1st Mtg. 5's, due 1930, M. & N.	1,500,000	1,000	103	105
The Brooklyn Union	15,000,000	1,000	139	144
1st Con. 5's, due 1948, M. & N.	15,000,000	—	106¾	107
Yonkers	999,650	500	180	—
Out-of-Town Companies.				
Bay State	50,000,000	50	1-1-16	1⅛
" Income Bonds	2,000,000	1,000	—	75
Binghampton Gas Works	450,000	100	—	—
" 1st Mtg. 5's	509,000	1,000	97	100
Boston United Gas Co.—				
1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	2,000,000	1,000	47½	50
Buffalo City Gas Co.	5,500,000	100	5	8
Bonds, 5's	5,250,000	1,000	59	60
Capital, Sacramento	500,000	50	—	35
Bonds (6's)	150,000	1,000	—	—
Chicago Gas Co. Guaranteed Gold Bonds	7,660,000	1,000	104	106¼
Cincinnati Gas and Electric Co.	29,500,000	100	87	90
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,500,000	1,000	96	98
Columbus (O.) Gas Lt. & Heating Co.	1,682,750	100	90½	91
Preferred	3,026,500	100	75½	80
Consumers, Toronto	2,000,000	50	200	204
Consolidated, Baltimore	13,460,084	—		—
Mortgages, 5's	3,400,000	—		—
General Mortgage 4½	10,661,000	—		—
Con. Gas Co., Baltimore City, 4½	2,751,000	—		—
Consolidated Gas Co. of N. J.	1,000,000	100	15	—
Con. Mtg. 5's	976,000	1,000	94	96
Bonds	75,000	—	—	100
Detroit City Gas Co.	6,580,000	—	—	50
Detroit Gas Co., 5's	381,000	1,000	75	80
" Prior Lien 5's	5,619,000	1,000	97	100½
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	—	101
Essex and Hudson Gas Co.	6,500,000	—	133	136
Fort Wayne	2,000,000	—	—	—
" Bonds	2,000,000	—	55	—
Grand Rapids Gas Light Co., 1st Mtg. 5's	1,350,000	1,000	100	101
Hartford	750,000	25	190	200
Hudson County Gas Co., of New Jersey	10,500,000	—	130	133
" Bonds, 5's	10,500,000	—	104	106
Indianapolis	2,000,000	—	38	45
" Bonds, 5's	2,650,000	—	104½	105
Jackson Gas Co.	250,000	50	82	—
" 1st Mtg. 5's	290,000	1,000	91	
Kansas City Gas Light Co., of Missouri	5,000,000	100	—	86
Bonds, 1st 5's	3,322,000	1,000	98½	99
Laclede Gas Co., St. Louis	10,000,000	100	103½	104½
Preferred	2,500,006	100	99	102
Bonds	10,000,000	1,000	102¾	103
Lafayette Gas Co., Ind.	1,000,000	100	—	60
Bonds	1,000,000	1,000	60	65
Louisville	2,570,000	50	130	130
Madison Gas and Electric Co.				
" 1st Mtg. 6's	400,000	1,000	105	
Massachusetts Gas Companies, of Boston	25,000,000	100	92	92¾
Preferred	25,000,000	100	94¼	94¾
Montreal Gas Co., Canada	2,000,000	100	228	229
Nashville Gas Light Co.	1,000,000	100	110	—
Newark, N. J., Con. Gas Co.	6,000,000	—	97	98
Bonds, 6's	6,000,000	—	127	128
New Haven Gas Co.	5,000,000	25	182	190
Peoples Gas Lt. & Coke Co., Chicago	25,000,000	100	114½	115½
1st Mortgage	20,100,000	1,000	102	102½
2d "	2,500,000	1,000	104	—
Rochester Gas & Electric Co.	2,150,000	50	88	—
Preferred	2,150,000	50	115	—
Consolidated 5's	2,000,000	—	104¾	105½
Pacific Gas and Electric Co.	15,500,000	—	62¼	62½
St. Joseph Gas Co.—				
1st Mtg. 5's	1,000,000	1,000	96	98
St. Paul Gas Light Co.	2,500,000	100	—	—
1st Mortgages, 6's	650,000	1,000	104	105
Extension, 6's	600,000	1,000	113¾	115
General Mortgage, 5's	3,447,000	1,000	94	96
Syracuse Gas Co., N. Y.	1,975,000	100	50	55
Bonds	2,047,000	1,000	101	103
Washington (D. C.) Gas Co.	1,600,000	200	427½	430
1st Mortgage, 6's	600,000	—	—	—
Western Gas Co., Milwaukee	4,000,000	—	—	—
Wilmington (Del.) Gas Co.	600,000	50	—	—

MEETING TIMES OF THE VARIOUS GAS ASSOCIATIONS.

American Gas Institute.—Annual meeting, October 15-17, 1913. Officers: President, W. R. Addicks, New York City. Secretary, Geo. G. Ramsdell, 29 West 39th st., N. Y. City.

Canadian Gas Association.—Annual meeting Sept. 1913. Officers: President, Arthur Hewitt, Toronto, Ont.; Secretary and Treasurer, John Keillor, Hamilton, Ont.

Empire State Gas and Electric Association.—Annual meeting, New York City, Oct. 8, 1913. Officers: President, C. G. M. Thomas, Long Island City, N. Y.; Secretary, C. H. B. Chapin, 29 W. 39th street. New York City.

Gas Meters.—Next Meeting, January; Chairman, Will W. Barnes; Commissioners, W. H. Pettes, L. W. Pefly; Secretary, H. Thurston Owens, 42 Pine street, New York City. Philadelphia Section; Chairman, L. R. Dutton; Commissioners, S. Grady, H. P. Dains: Secretary, H. F. Patterson, Jr., 834 Chestnut street.

Guild of Gas Managers of New England.—Annual meeting, March, 1913. Young's Hotel, Boston; monthly meeting, second Saturday. Officers: President, Walter G. Africa, Manchester, N. H.; Secretary, H. K. Morrison, Brockton, Mass.

Illinois Gas Association.—Annual meeting, March 19th and 20th, 1913. Chicago, Ills. Officers: President, H. O. Channon, Quincy, Ills.; Secretary-Treasurer, Horace H. Clark, 115 No. Oak Park avenue, Oak Park, Ills.

Illuminating Engineering Society.—Annual meeting,———— September, 1913. Meetings of Sections, monthly. Pres., V. R. Lansingh, Cleveland, O.; Sec., Preston S. Millar, 29 W. 39th street, New York City, Sections: New York, Secretary, C. L. Law, 124 West 43d street. New England, Secretary, H. C. Jones, 10 High street, Boston, Mass. Philadelphia, Secretary, L. B. Eichengreen, Broad and Arch streets. Chicago, Secretary, J. B. Jackson, 28 North Market street. Pittsburgh, Secretary, J. C. Mundo, Oliver Building.

Indiana Gas Association.—Annual meeting, March 12 and 13, 1913. Indianapolis. Officers: President, Howard L. Olds, Indianapolis; Vice-President, Wm. Wallace, Lafayette; Secretary-Treasurer, Philmer Eves, Indianapolis.

Iowa District Gas Association.—Annual meeting, May 22, 23, 24, 1913; Burlington, Ia. Officers: President, C. W. Fair, Atlantic, Ia.; Secretary, G. I. Vincent, Des Moines, Ia.

Kansas Gas, Water and Electric Light Association.—Annual meeting, October—— 1913. ———— Officers: President, L. O. Ripley, Emporia, Kas.; Secretary and Treasurer, W. H. Fellows, Leavenworth, Kas.

Michigan Gas Association—Annual meeting, September——1913; ———— Officers: President, W. S. Blauvelt, Detroit, Mich; Secretary-Treasurer, Glenn R. Chamberlain, Grand Rapids, Mich.

Missouri Electric Light, Gas, Water Works and Street Railway Association.—Annual meeting, April, 1913; Mexico, Mo. Officers: President, P. A. Bertrand, Joplin, Mo.; Secretary and Treasurer, P. W. Markham, Brookfield, Mo.

National Commercial Gas Association.—Annual meeting————————1913. Philadelphia, Pa. Officers: President, C. W. Hare, Philadelphia Pa.; Secretary, Louis Stotz, 29 West 39th street, New York City.

Natural Gas Association.—Annual meeting, Cleveland, O., May 20-22, 1913; Officers: President, M. B. Daly, Cleveland, O; Secretary, T. C. Jones, Delaware, O.

New England Gas Association.—Annual meeting, February, 19th and 20th, 1913 Boston. Officers: President, D. D. Barnum, Worcester, Mass.; Secretary-Treasurer, N. W. Gifford, East Boston, Mass.

New Jersey State Gas Association.—Annual Meeting, April —, 1913, ———— N. J.—President, William H. Pettes, Newark, N. J.; Secretary-Treasurer, Arthur H. Osborn Belmar, N. J.

Ohio Gas Association.—Annual meeting, February ————, 1913, Columbus, O.; President, John M. Garard, Columbus, O.; Secretary, L. B. Denning, Columbus, O.

Oklahoma Gas, Electric and Railway Association.—Annual meeting, Oklahoma City May, ——1913. President, F. W. Caldwell, Shawnee, Okla.; Secretary, H. V. Bozell, Norman, Okla.

Pacific Coast Gas Association.—Annual meeting, San Jose, Cal., September 16, 17, 18, 1913. Officers: President, Henry R. Adams, Stockton, Cal.; Secretary-Treasurer, Henry Bostwick, 445 Sutter street, San Francisco, Cal.

Pennsylvania Gas Association.—Annual meeting, York, Pa., April 9-11, 1913; Officers, President, H. H. Ganser, Norristown, Pa.; Secretary-Treasurer, W. O. Lamson, Jr., West Chester, Pa.

Society of Gas Lighting.—Annual meeting Dec., 11, 1913; monthly meetings, second Thursday. Place, New York City. Officers: President, Fred. S. Benson; Secretary, George G. Ramsdell, 29 West 39th street, New York city

Southern Gas Association.—Annual meeting, Charlotte, N. C., April 18-20, 1913, Officers: President, C. E. White, Montgomery, Ala.; Secretary-Treasurer, E. D. Brewer, Atlanta, Ga.

Southwestern Electrical and Gas Association.—Annual meeting. May 21, 22, 23 and 24, 1913, Galveston, Tex. Officers: President, F. M. Lege, Jr., Galveston, Tex.; Secretary H. S. Cooper, 405 Slaughter Bldg., Dallas, Tex.

Wisconsin Gas Association.—Annual meeting, May 14 and 15, 1913, Milwaukee, Wis. Officers: President, I. F. Wortendyke, Janesville, Wis.; Secretary-Treasurer, Henry Harmon, Milwaukee, Wis.